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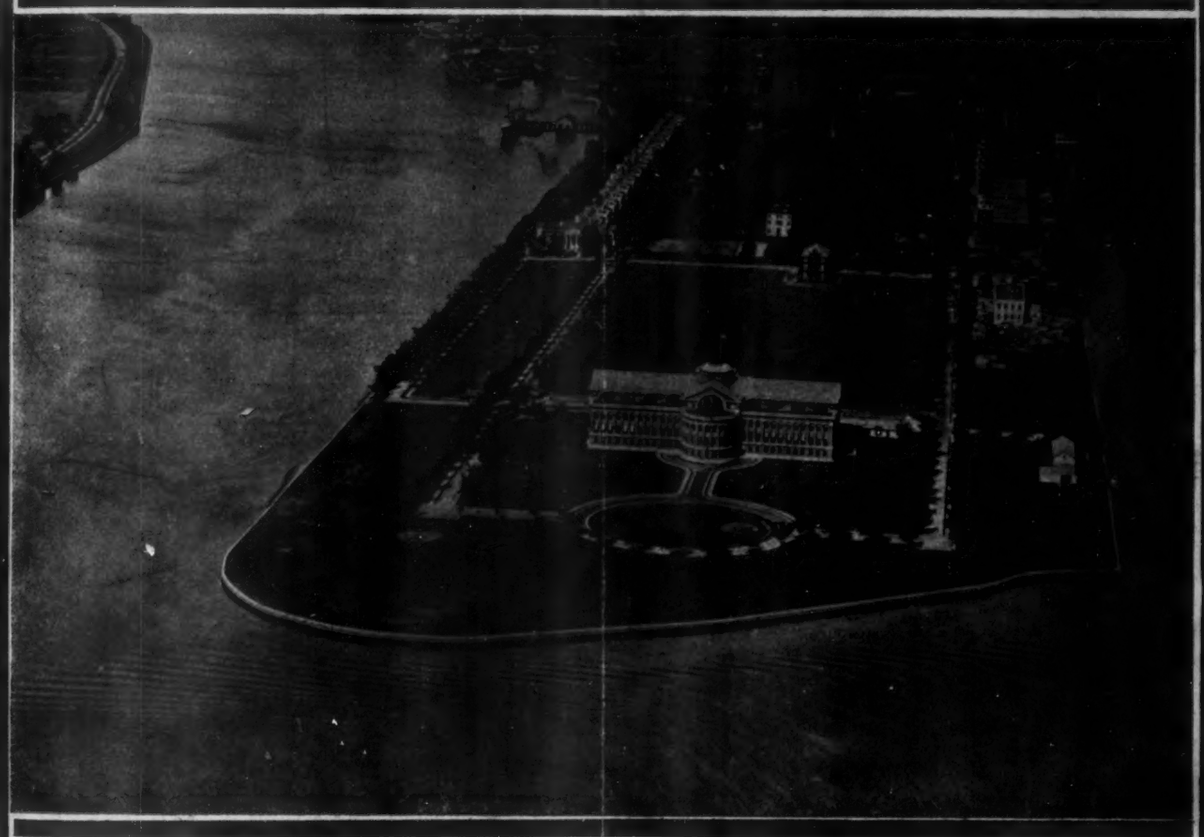

The General Staff College and Washington Barracks, Washington, D. C.

VOLUME XI
Number 13

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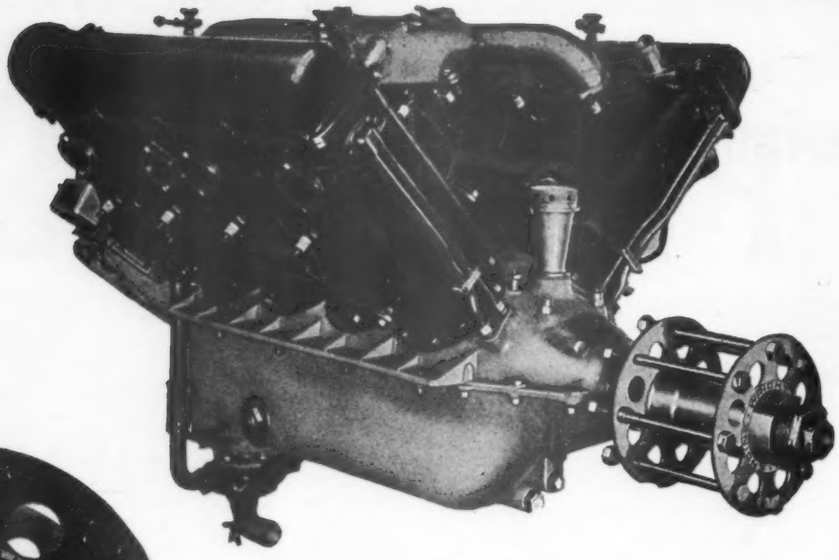

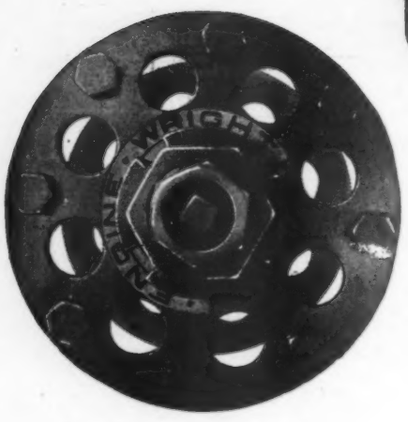

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AVIATION AND AIRCRAFT JOURNAL

SEPTEMBER 26, 1921 VOL. XI. NO. 13

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INDEX TO CONTENTS

Editorials	363	St. Louis Firm Moves	372
Single Engined Cabin Airplanes	364	Two New Hanriot Airplanes	373
Washington Letter	366	Airships for Transatlantic Service	374
Czechoslovak Duties on Engines	366	Oil Prospecting by Airplane	376
Canadian Air Board Report	366	General Menoher Resigns	377
Gen. Mitchell Attacks Bomb Findings	367	Canada Recognizes Underwriters' Aircraft Register	377
A Letter	367	Standard J-1 with Mercedes Engine	377
Huff-Daland HD-4 Training Airplane	368	The Santa Maria	377
Fuel Problem for Engines	370	Aviation in Spokane, Wash.	377
Chicago Air Race	370	American Airways, Inc.	378
Analysis of Aviation Accidents	371	Rockaway Hangar and D-6 Burned	378
British Air Secretary Arrives	372	New French Airway Guide	378
Secretary Denby's Seaplane	372	American Aircraft in Canada	378

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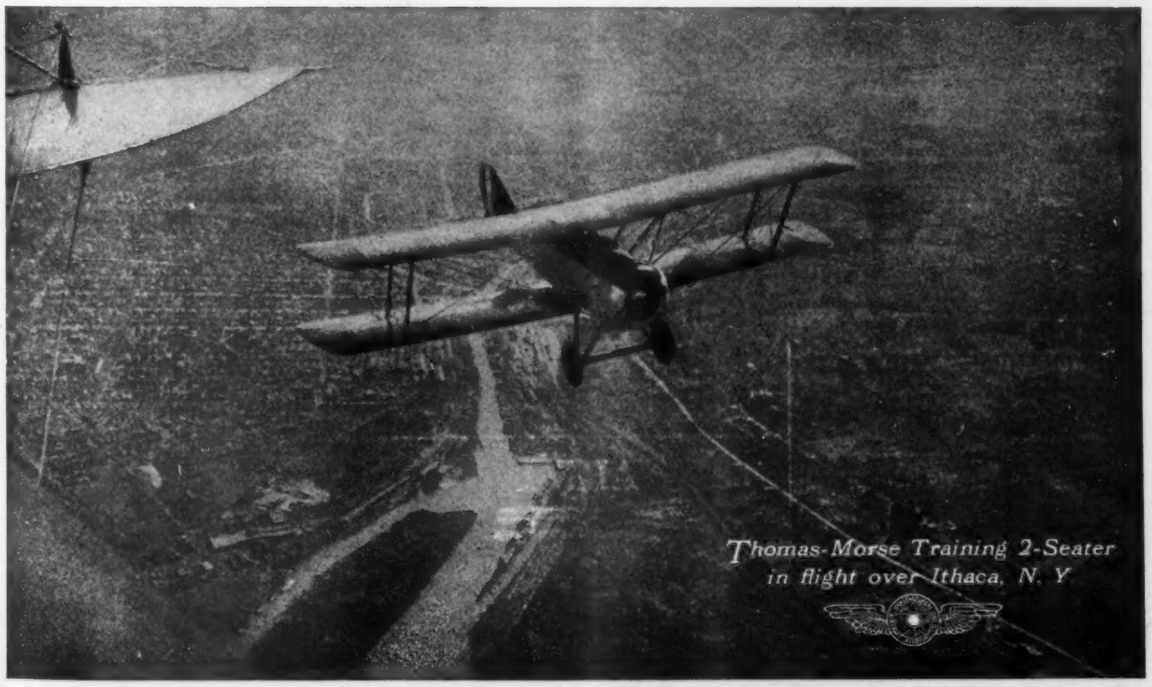

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LADISLAS D'ORCY, EDITOR
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Vol. XI SEPTEMBER 26, 1921 No. 13

A National Crisis

MAJOR GENERAL MENOHER'S request to be relieved as Chief of Air Service brings to an immediate issue a vital national problem—whether our Army Air Service is to be directed by practical flying men or not.

General Menoher naturally wishes to conclude his army career with the troops. It is in that field that he has won great distinction. He very naturally and properly may feel that his work in organizing the Air Service is finished, and probably he realizes that he can make no further contribution to the development of the Air Service.

The Army Air Service in the past has been directed by non-flying chiefs. Although this course may have been necessary, it has not been satisfactory, and its continuation in the future will continue and accentuate the embarrassments of the past.

The Secretary of War would be very properly criticized if he appointed as Chief of Coast Artillery anyone but a Coast Artillery officer. It is impossible to think of anyone in the position of Chief Signal Officer except an officer who has been technically trained and who has gained distinction in that specialty. It is time that the Secretary of War recognized the necessity of selecting as Chief of the Army Air Service, a flying officer.

All countries recognize aircraft as indispensable weapons. Other nations, under the direction of flying officers, are building up air forces and aerial reserves as their first line of defense. Supremacy in the air is the new watchword. Far reaching development is under way abroad and practically everywhere except in the United States it is under the direction of officers who know from their own experiences in the air, the possibilities and limitations of air power. The most competent flying men, officers of particular achievement have been placed in direct charge of this highly specialized work.

How can we expect to develop the proper *esprit* in the personnel of the Army Air Service, except under the leadership of a flier? How can we expect the Army Air Service to take its proper place among the armed forces unless the Chief of the Air Service represents the flying personnel?

The resignation of Major General Menoher as Chief of the Army Air Service presents a crisis in our plans for national security. It opens an opportunity for the Secretary of War to correct a condition which has existed since the beginnings of military aviation in this country and which, more than any other single factor, has been responsible for our tardy development in the air.

Flying as an element in national defense dates practically from 1914. In its inception it was necessarily placed under the direction of the older services. By the close of the World War it had won recognition in all the major belligerent nations as a distinct arm requiring control by men who were fliers and who thought of fighting in terms of the air.

During the last administration, the Army Air Service was under two non-flying officers—General Squier, of the Signal corps and General Kenly of the Cavalry. At the front, in France, the Air Service of the A.E.F. was under a flying officer, General Mitchell. At the close of the war, and before Mitchell's return, General Kenly was succeeded as chief of military aviation in this country, by General Menoher, of the Infantry.

General Menoher now retires voluntarily. General Mitchell has been his assistant for several years. To his practical experience in the air in France he has added administrative training under General Menoher. The morale of the service, judged from recent developments, requires a flying officer in the vacancy created by General Menoher. The fliers *are* the Air Service. They want an airman to command them. If a flying officer is not chosen, our aerial defenses will suffer. The Secretary of War is urged to consider this and to seize the opportunity by advancing General Mitchell to the position of chief.

Progress in Commercial Airplane Design

THE article on single engined cabin airplanes which is printed in the present issue affords a valuable indication of the manner in which commercial airplanes have increased in efficiency since the Armistice. While a full discussion of this question would necessarily involve a detailed comparison of the constructional features of each machine, the characteristics listed in the table nevertheless enable us to draw certain conclusions as to the points which are mainly instrumental in improving the efficiency of commercial airplanes.

Taking into consideration only the airplanes specially designed for commercial exploitation, and actually built, we find that of the six machines having the highest figure of merit four are monoplanes and two are biplanes. Taken in their respective order of merit, they are the Junkers JL-6, the Spad S-33, the Fokker F-3, the Dornier C-3 ,the Curtiss Eagle III and the Jacuzzi. That a cantilever monoplane should head this list is but natural in view of the greater efficiency of its wing arrangement and low parasite resistance. What is however surprising is to find the Spad biplane more efficient than the Fokker and Dornier monoplanes. The only acceptable explanation of this fact seems to be that the Spad overcomes the inherent interference of a biplane arrangement by a peculiar setting of the wings, consisting of a swept-back top plane staggered forward over a small straight bottom plane. Furthermore, the Spad is much more carefully streamlined than either the Fokker or the Dornier cabin airplanes, in which straight lines and angles predominate, whereas the Spad has a circular section fuselage.

Single-Engined Cabin Airplanes

By Donald W. McIlhiney

During the war aeronautical engineers had very little cause or opportunity to consider the requirements of a commercial airplane. After the signing of the armistice there was an immediate demand for air transport services. Perhaps the first organized service of importance was that between London and Paris which was inaugurated to carry English government officials to and from the peace conference. Aviation enthusiasts predicted that airways would cover the globe in a very short time. But experience has shown that the stage was not yet set for such an event.

The principal reasons for the slow development of air transport have been lack of financial support and the inadaptability of existing designs. The lack of financial support had two phases; the inevitable dearth of new capital due to the after-the-war depression and the withdrawal or diversion of a considerable amount of capital already invested. This latter phase was caused by investors who were only interested in aviation so long as it paid war profits. Without ample capital it was impossible to construct the necessary machines, operate them and in addition educate the public and organize the extensive ground services required. That airways exist today in Europe, is largely due to the various governments taking the organization of airports, meteorological and radio services, etc. off the shoulders of the operating companies.

The development of the machines can be divided into three periods. The first is marked by the attempted use of surplus war machines. For a time the idea that putting a couple of seats and a little roof in the rear cockpit, converted a military machine into a commercial machine, was almost universally held. The second period was marked by luxurious fittings, the idea being that the principal need was public patronage and that gilt and velvet was the way to get it. The third and present period is marked by the realization that dollars and cents are the principal factors in any commercial enterprise. The idea of comfort has now assumed its proper place.

Practically all the present day commercial machines are either twin- or single-engined machines, with the single-engined type in the majority. It is with the second type that we are concerned here. It should be noted though, that the larger machines have not developed as rapidly because there is not yet enough business to give them sufficiently large loads. In the appended table are given the data concerning forty-two machines of this type. This does not include all machines as the data is not available, however the exceptions are relatively unimportant. The principal machines not included are the Airco 4a, the Bristol Tourer and the Sablatnig conversion. Production is so slow that types, even in a single factory, have not been standardized. At least half the machines listed in the table have appeared with different engines which naturally changes both the pay load and the performance. This fact should be considered if any discrepancies are noted in the table.

The Figure of Merit (F.M.) given in the last column is derived from and equal to, the one proposed in AVIATION AND AIRCRAFT JOURNAL for Nov. 8, 1920. It is calculated as follows:

$$\frac{V_{80\text{ per cent max}} \times \textit{pay load} \times \textit{range}}{V_{\text{landing}} \times \textit{power}}$$

It provides a useful basis for discussion, whether or not it is the best index, including as it does, speed range, pounds of pay load carried per horsepower and range.

One acquainted with the field will note that the table includes many machines which were only constructed for exhibitions or have never appeared in more than one or two examples. If those machines whose Figure of Merit is less than 2,500 be rejected, it will be found that the converted war machines and the class mentioned above have been eliminated. The remainder are as follows: Curtiss Eagle III, Bellanca CF, Jacuzzi, Fokker F3, Von Cuyk, BAT FK26, Airco 18, Sopwith Wallaby, Westland Limousine III, the new Bristol, Potez IX, Spad S33, JL6, Sablatnig P3, Albatross L57, Zeppelin Dornier C3 and Ansaldo A300C. To this list the Davis Douglas Cloudster would undoubtedly be added if data were available, making a total of eighteen. Included in this group are the Bellanca which has not been built and the Sopwith Wallaby which was never built for commercial use, the only example being a special machine for the Australia flight. With these two exceptions, it will be seen that all these machines have proved themselves in service, as far as national facilities and time permitted.

It is interesting to note the relation between the number of machines in this selected list (F.M. 2,500 or greater) and the total in the table for any given year. In 1918 there is only one machine in either group and as this machine was far ahead of its time when produced no fair ratio may be obtained. In 1919 there are 17 machines listed, four of which fall in the selected group, a percentage of 23.5. In 1920 there are five in the selected group to 16 in the table a percentage of 31.2. For as much of 1921 as has been published, there are eight out of a total of eight or a perfect score. These figures illustrate the change of viewpoint from that of the converted war machine to the machine designed on a dollars and cents basis. While there are several types in service today that are not included in the selected list, it is doubtful if any of them will be replaced when worn out.

The average machine of the selected list is one with a 304 hp. engine carrying six passengers or a pay load of 1031 lb. for 525 miles at a speed of 113 m.p.h. By comparison with the averages given at the foot of the table it is seen that this machine is both bigger and faster than that average. As business becomes better this class of machine will probably get larger and larger until replaced by multi-engined machines, unless engine size and reliability increase proportionately. Of course, this does not mean that the class will disappear as there will always be airways where the traffic will not be heavy enough to warrant employing the larger machines.

In regard to the number of wings the table gives some evidence of the trend. Of the total number there are 31 biplanes, nine monoplanes and only two triplanes. In the selected list there are ten biplanes and eight monoplanes with no triplanes. This gives a percentage of 44.5 for the monoplanes. Of the eight 1921 machines, half or 50 per cent are monoplanes. These figures show the growing favor for the monoplane, especially the cantilever type, for this size of machine. When all the machines built this year can be included it is probable that the percentage of monoplanes will be still greater.

There are 26 different engines enumerated in the table. Napier Lion, 3 BMW 3a, 2 Liberty 12, 2 Rolls Royce Eagle In the selected list there are 18, distributed as follows: 3 VIII, and one each of the following, Anzani, Hall Scott L6, BMW 220, Benz 220, Lorraine Dietrich 370, Salmson 250, Maybach and Fiat A12bis.

In regard to numbers it is impossible to do more than consider the number of designs, as aviation is only just beginning to be an industry where accurate statistics are at all valued. Practically every commercial machine is made to order, such a thing as making twenty-five machines in a series is almost unknown; and while there are exceptions, they merely prove the rule.

Minor details not included in the table such as brakes, mufflers, etc. are as yet in the experimental stage. As the number of airplanes and competition becomes keener such things will be more and more considered. Technical advances such as superchargers and variable pitch propellers are also still being developed. But the principal factor in the design of future machines will undoubtedly be the cost per passenger-mile, or per ton-mile, as in other means of transportation. Only when the cost will have been reduced to the practical limit will the minor matters of comfort, etc. become a factor between competing airways.

TABLE OF CHARACTERISTICS OF SINGLE-ENGINED CABIN AIRPLANES

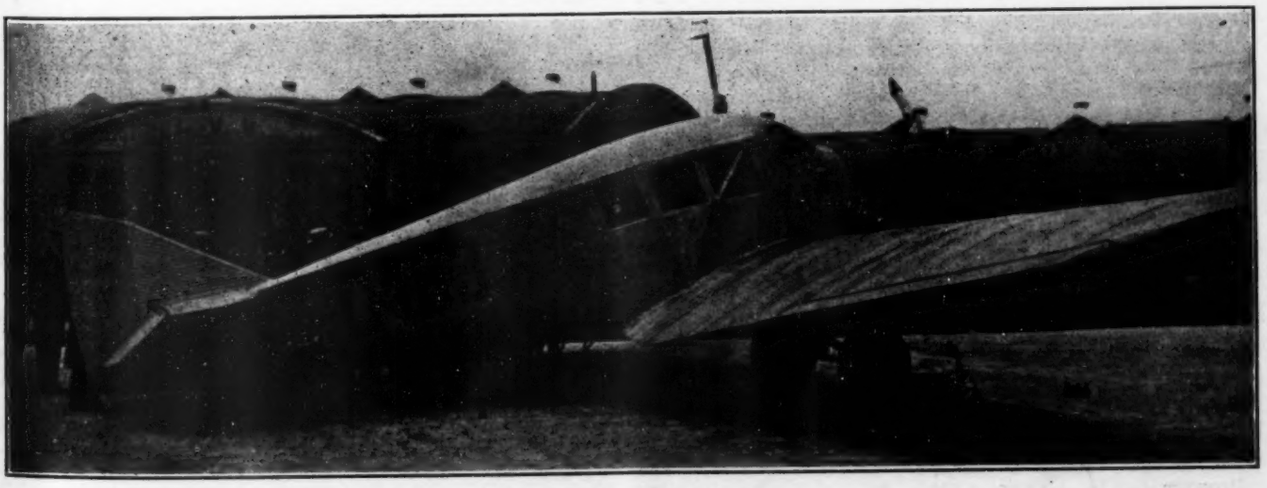
Make	Name	Year	Nation	Type	Span ft.	Span in.	Length ft.	Length in.	Height ft.	Height in.	Engine	Power hp.	No. Pass.	Weight Empty lb.	Useful Load lb.	Pay Load lb.	Total Weight lb.	Area ft.²	lb./hp.	lb./ft.²	Maximum Speed mph	Landing Speed mi.	Range mi.	FIGURE OF MERIT
Dayton Wright	D4K	19	A	B	42	5.5	30	1.5	11	9	Liberty 12	420	2	2400	1010	300	3410	431	8.12	7.66	115	*50*	*460*	649‡
Dayton Wright	OW1	19	A	B	46	0	28	9	9	0	Hispano-Suiza E	180	2	1450	1042	330	2492	534	13.85	4.67	95	35	*510*	2284
Dayton Wright	KT	19	A	B	43	7.2	30	1.5	11	2.5	Liberty 12	420	2	2686	1442	308	4828	441	9.83	9.36	120	*55*	*600*	864
Curtiss	Eagle III	20	A	B	64	4.1	36	7.2	12	11	Liberty 12	400	8	4245	3180	1280	7425	*934*	18.58	7.95	100	51	675	4444
Lincoln Standard	Cruiser	20	A	B	41	0	26	4	6	0	Hispano-Suiza	220	4	1800	1350	*824*	3150	456	14.34	6.90	95	47	350	2385
Bellanca*	CF	21	A	M	40		22	9	7	7	Anzani	95	4	870	1080	*640*	1950	280	20.50	6.95	108	42	585	9100*
Davis Douglas	Cloudster	21	A	B	56		35		13		Liberty 12	400												
Jacuzzi		21	A	M	52		29		10	6	Hall-Scott L6	215	6	1800	1600	*960*	3400	400	15.86	8.50	*110*	45	*445*	4371
Fokker	F2	20	H	M	52	9	39	3	12		B. M. W. 3a	185	6	2645	1542	1000	4187	452	22.63	9.27	93	*46*	475	1860
Fokker	C2	20	H	B	34	9	23	8	9	5	B. M. W. 3a	185	2	1820	780	*355*	2600	290	14.05	8.97	115	45	450	1986
Fokker	F3	21	H	M	56	3	36		11		B. M. W.	220	5	2640	1760	1050	4400	452	20.00	9.75	105	*47*	*525*	5038
N. A. V. O.	Van Cuyk	21	H	M	45	3.2	31	2	11	2	Benz	220	4	2425	1433	*725*	3858	388	17.54	9.96	106	*47*	*535*	3579
B. A. T.	FK26	18	E	B	46	0	34	8	11	3	R. R. Eagle VIII	375	4	2700	1800	*840*	4500	544	12.00	8.28	122	50	*625*	3074
Airco	16	19	E	B	46	5.9	31	10.5			R. R. Eagle	330	4			*600*		466			113	*50*	*400*	1489‡
Airco	18	19	E	B	50	5	39	0	13	6	Napier Lion	450	8	4180	2550	*1540*	6730	618	14.96	10.89	121	*55*	*400*	2710
Avro	Limousine	19	E	B	36	9					BR-1	150	4	1431	1055		2486	335	16.57	7.42	90	40		
Sopwith†	Wallaby	19	E	B	46	6	28	0	12	0	R. R. Eagle	360	7			*1320*	5200	550	14.44	9.45	121	48	500	4159†
Sopwith	Gnu	19	E	B	38	0	25	6	10	0	Le Rhone	110	2	1350	810	*460*	2160	350	19.62	6.18	93	40	*279*	2331
Westland	Limousine I	19	E	B	38	2	28	6	10	9	R. R. Falcon III	275	3			*500*	3560	435	12.93	8.19	115	*50*	*345*	1298
Avro	547	20	E	T	37	0	29	8.2	14	3	Beardmore	160	4	2077	1123	*683*	3200	498	20.00	6.42	85	40	*275*	2245
Beardmore	WB10	20	E	B	46	0	26	0	11	0	Beardmore	200	1	1852	997	*342*	2849	509	14.24	5.61	95	40	*425*	1553
Sopwith	Antelope	20	E	B	46	6	36	6	11	0	Hispano Viper	180	2	2100	900	*344*	2900	550	16.67	5.45	100	38	*400*	1438
Westland	Limousine II	20	E	B	38	2	28	6	10	9	Hispano-Suiza	300	3			*716*	3800	435	16.00	8.74	115	*52*	*520*	2455
Westland	Limousine III	20	E	B	54	0	33	6	12	6	Napier Lion	450	5			*1040*	5550	726	12.33	7.65	120	*48*	*540*	2808
Bristol		21	E	B	54	0	42	0	11	0	Napier Lion	450	8	3900	2901	1680	6801	*672*	15.11	*10.12*	122	*53*	400	3094
Breguet	14T	19	F	B	47	1	29	6	10	10	Lorraine-Dietrich	300	3		1610	*723*		527			110	*50*	*350*	1670‡
Breguet	18T	19	F	B	57	1	34	2	11	8	Renault	450	6	3530	2424	*1138*	5954	791	13.22	7.52	105	*49*	*410*	2000
Potez	SEA-VII	19	F	B	46	3	39	5	10	7	Lorraine-Dietrich	370	2	2420	1210	*501*	3630	473	9.81	7.54	124	*49*	*310*	956‡
Spad	S27	19	F	B	31	10	23	11.5	9	2.5	Hispano-Suiza	300	2	1873	905	*300*	2778		9.26		137	65	*410*	778
Nieuport	30T	20	F	B	47	6.8	35	2			Renault	450	5	3308	1985	*1275*	5293	700	11.75	7.56	118	*48*	*265*	1661
Potez	IX	21	F	B	45	11.1	32	3.5	9	10.1	Lorraine-Dietrich	370	4	2535	1609	926	4144	474	11.20	8.74	125	*50*	*622*	3503
Spad	S33	21	F	B	38	4	29	9	10	5	Salmson Z-9	250	5	2204	2204	*1150*	4408	463	17.63	9.52	112	*53*	*580*	5074
Aviatik	F	19	G	B	49		25	11	10	2	Benz 12	300	2	2318	1245	550	3563		11.88		112	*48*	326	1255‡
Hawa	F3	19	G	B	39	4	25	7			Argus	180	2	1650	753	*296*	2403	355	13.35	6.77	*105*	*45*	*315*	1103‡
Junker	JL6	19	G	M	48	8	28	9	10	0	B. M. W. 3a	185	5	2317	1288	655	3605	417	19.49	8.64	111	*44*	*777*	6246
Sablatnig	P3	19	G	M	52	6	29	4	10	8	Maybach	260	6	3085	1875	992	4960	484	19.08	10.25	*118*	*49*	326	2582
Albatross	L57	20	G	M	52	6	34	3	11	6	B. M. W. 3a	185	6	2317	1894	1259	4211	520	22.76	8.10	96	*43*	*288*	3938
D. F. W.	C5	20	G	B	32		23		9		Benz	230	2	2293	1058		3351		14.57					‡
Hawa	F10	20	G	T	37	9.6	26	10	12	9.5	Benz	220	4	2380	1091	*512*	3471	484	15.78	7.16	105	*43*	466	2383
Rumpler	5A2	20	G	B	39	5	26	3	9	10.2	Mercedes	160	2	1763	1107	*530*	2870	*364*	17.94	*7.88*	93	*46*	465	2424
Zeppelin	DoC3	20	G	M	55	9.2	32	9.8	7	2.5	B. M. W. 3a	185	6	2756	1322	*800*	4078	506	22.04	8.07	107	*43*	520	5037
Ansaldo	A300C	20	I	B	44	9	31	6	10	9.5	Fiat A12bis	300	4	2534	1653	*668*	4187	473	13.96	8.85	118	43	*590*	3245
TOTALS & AVERAGES	42				45	6	29	9	9	8		275	4	2390	1489	772	3957	433	15.49	8.08	109	47	455	

Abbreviations used in Table

N. A. V. O.—Nederlandsche Automobiel und Vliegtuig Onderneming.
B. A. T.—British Aerial Transport Co.
D. F. W.—Deutsche Flugzeug Werke.
B. M. W.—Bayerische Motoren Werke.
R. R.—Rolls Royce.
A—American.
H—Dutch.
E—English
F—French
G—German.
I—Italian.
B—Biplane.
M—Monoplane.
T—Triplane.

*—Designer's estimates; machine not yet built.
†—Data taken from Australia flight machine.
‡—Conversion.

The *italics* indicate that the figure given was obtained indirectly.



JUNKER JL6 CABIN MONOPLANE WHICH HAS THE HIGHEST FIGURE OF MERIT (6246) IN THE ABOVE TABLE OF CHARACTERISTICS OF SINGLE-ENGINED CABIN AIRPLANES

Washington Letter

By Our Special Correspondent

Night bombing may be attempted when the Army Air Service bombs the obsolete battleship Alabama, scheduled now for some time in October in Chesapeake Bay.

Such an attack will be launced if the night bombing practice now in progress at Langley Field, Va., demonstrates that the fliers have progressed sufficiently with this phase of operations. The practice has been in progress for approximately a month and is said by Air Service officers in Washington to be going along with good success.

Up to this time not more than four airplanes have been up at one time at night. The reason for this is to minimize the possibility of accidents, and so far there have been none. The DH-4 type of airplanes has been used.

Flares, a searchlight and ordinary red and green running lights are operated in connection with the night bombing practice. The flares are used to light up the target. The search light, at a vertical, is intended to give the fliers their bearings. In the event of a forced landing the search light would be lowered to assist the pilot in finding a suitable place to land to avoid a crash and also to prevent a collision due to the airplane getting out of the formation. The running lights are obviously invaluable.

Just when the attack on the Alabama is to be held so far has not been decided, due to the fact that the Navy Department has not turned the ship over to the Army. The work of dismanteling the battleship, it was said at the Navy Department, is progressing at the Philadelphia Navy Yard. The prospects are that the work will be completed so that the battleship may be turned over to the War Department about October 1.

This delay is said to be due to the settlement of a question that arose when the Army Air Service asked that the battleship be in commission at the time of the attack. Under the Navy rules, however, the officers are required to strip a war ship of compasses and other appliances once she is declared obsolete and ready for target practice.

When the Army request was received the question of what should be done occupied officials for some time, but it finally was suggested that the Army pay for the equipment which was to be destroyed. This the Army could not do, because of lack of funds. Consequently the battleship is to be stripped of such material as might be used aboard other vessels of the fleet.

One of the things the Army Air Service particularly desired was that the Alabama's magazines be filled with ammunition. Due to the financial situation existing in the services, however, this also has been abandoned.

The Army Air Service sent an invitation to the Bureau of Naval Aeronautics asking the Naval fliers if they wished to participate in the operations, which are to be held in Chesapeake Bay in the general vicinity of the hulk of the old battleship Indiana. The Navy declined the invitation, however, on the ground that about that time it would be engaged in a series of airplane experiments which would occupy most of the time. These are believed to be practice in launching torpedoes from airplanes.

West Point and Aviation

The first class at West Point received a few pointers about the development of the airplane in modern-day combat when, on September 17, Major H. M. Hickam, of the Army Air Service, delivered a lecture.

Major Hickam, who is in charge of the information group of the Army Air Service, emphasized the present-day development of aircraft, tracing its past performances and showing the tremendous possibilities for the future. He showed that the chief forces of making war are the Army, the Navy, the Airplane, Industrial Preparedness, Political Activity and Propaganda.

Army Air Service officers are gratified that the authorities at West Point are showing an interest in the airplane and its possibilities in time of war. One of the serious handicaps of the past has been the failure of the older officers of the Army, who in many instances have determined policies, to realize the power of the airplane.

Naval Aviation Commissions

The Bureau of Naval Aeronautics is anxiously awaiting the action of the Secretary of the Navy with respect to the examinations recently held at the different Naval Air Stations for permanent commissions for flying personnel.

Until the report of the Secretary of the Navy is received the permanent assignments to stations cannot be made. Lieut. Commander Ballinger, in charge of flight, in the Bureau of Naval Aeronautics, is ready to make the recommendations for assignments as soon as the final action on the lists is forthcoming.

The examinations were held in May. Those who took them were temporary and reserve officers seeking permanent commissions in the Naval Air Service.

Ass't. Chief of Naval Aviation

Capt. Henry C. Mustin, in charge of aircraft assigned to the Pacific Fleet, who has been passing the last two months at the office of Rear Admiral Moffett, chief of the Bureau of Naval Aeronautics, will leave in a few days for San Francisco to rejoin the Pacific Fleet.

Capt. Mustin's stay on the coast will be brief, as he will return to Washington within a month to receive the appointment as assistant chief of the Bureau of Naval Aeronauties.

Settlement for the R-38

When the time comes to take up the matter of the financial adjustment incident to the wrecking of the R-38 a proposal will be made to the British Government that one of the one time German dirigibles be turned over to the United States. Just how this suggestion will be received by the British cannot be contemplated, but the Naval officers connected with aviation, particularly lighter-than-air craft, are hopeful it will bear fruit.

The British Government has three of the one time German airships. They were turned over to the British Government under the terms of the armistice.

They are much smaller than the R-38. One of them is only half the size, while two are about two thirds the size.

The contract price for the R-38 was $2,000,000, of which amount $1,500,000 had been paid to the British Government for the account of the manufacturers. Under the terms of the contract the United States was to pay half and the British Government half in the event of an accident.

Nothing has been done as yet regarding a financial settlement. The officers of the Navy have felt that this matter could wait until the bodies of the victims had been buried.

Czechoslovak Duties on Aircraft Engines

The Parliament of Czechoslovakia will shortly discuss a legislative scheme concerning the increase of import duty on automotive apparatus. According to this bill, aircraft engines, without distinction, would be subject to the following duties: 15,000 crowns each, minimum tariff; 20,000 crowns each general tariff. The proposed increase in customs duties is caused by the fact that the present tariffs do not protect home production, and bear no comparison with analogous duties levied by France, Italy, Great Britain and the United States.

Canadian Air Board Report

The latest report of the Canadian Air Board shows the number of certificates and licenses in force at the end of August to be as follows: Private Air Pilot's, 61; Commercial Air Pilot's, 93; Air Engineer's, 149; Air Navigator's, 1; Aircraft, 148; Airdromes, 29.

Gen. Mitchell Attacks Bomb Test Findings

A chapter has been added to the "aircraft versus capital ships" discussion that has caused so much comment in Washington this year.

This new development comes from a report made by Brig. Gen. William Mitchell, Assistant Chief of Air Service, on the bombing tests held two months ago off the Virginia Capes. The report was submitted to Maj. Gen. Charles T. Menoher, Chief of Air Service, in the form of a memorandum.

The report has not been issued for publication by the Chief of Air Service. Its appearance is expected to cause a greater sensation than that which occured in the Air Service administration last Spring when General Menoher warned General Mitchell to "speak softly".

Statements made by General Mitchell in his report are at considerable variance with the findings of the Joint Army and Navy Board which was appointed to report on the bombing experiments conducted with seacraft off the Virginia Capes last summer.

Summary of Assertions

The outstanding statements in the Mitchell report are:

Aircraft can operate under conditions when seacraft is helpless.

Aircraft can safely protect the entire coast.

Seacraft should cease operations when within 200 miles the coast.

All naval activities should be confined to the high seas.

Had the army air service been permitted to attack as it desired, the seacraft attacked would not have lasted ten minutes.

The first provisional air brigade could have put out of action the entire Atlantic fleet in one attack.

The problem of destruction of seacraft by airplane is finished. It has been solved.

The scheme of national defense should be revised at once on the following basis: A department of national defense, with sub-secretaries for army, navy and air service; a department of aeronautics co-equal with the Departments of War and Navy must be created at once.

The report stated that at present there is a complete lack of liason or system about our national defense. It scored the present coast defense system, asserting that at least $1,870,000,000, had gone to create a coast defense that is little more than useless against hostile aircraft and hostile sea forces.

Full Text of His Report

The report, as printed by *The New York Times,* says in part:

"Air forces with the types of aircraft now in existence or in development ,acting from shore bases, can find and destroy all classes of seacraft under war conditions with a negligible loss to the aircraft. It is not necessary to destroy hostile seacraft at a distance greater than twenty-five miles off shore in order to protect the coast, as this distance exceeds the range of the most powerful guns at present installed. Aircraft, acting from suitable floating airdromes, can destroy any class of surface seacraft on the high seas.

"Conditions of weather affecting the air and sea conditions do not alter the statement made above, as aircraft can operate in conditions under which seacraft cannot operate. There are no conditions in which seacraft can operate efficiently in which aircraft cannot operate efficiently.

"The weapons used in the recent exercises against the seacraft were bombs alone. Torpedoes, gas, gunfire and mines were not employed. The army air service was not permitted to attack the targets, as it would under actual conditions, and never was more than one-tenth of the brigade employed in a single attack.

"Had the army air service been permitted to attack as it desired, none of the seacraft attacked would have lasted ten minutes in a serviceable condition. The first provisional air brigade could have put out of action the entire Atlantic Fleet in a single attack. The value of the airplanes in the first brigade did not exceed the cost of a modern destroyer."

General Mitchell then explains how battleships under war conditions are much more vulnerable than the targets used in the bombing tests. A battleship with full steam up and speeding ahead is a target much easier to hit and to put out of commission than the targets used, he asserts.

"The problem of destruction of seacraft by forces has been solved and is finished," the report goes on. "It is now necessary to provide an air organization and a method of defending not only our coast cities, but our interior cities against the attack of hostile air forces. Our recent maneuvers show an enemy having gained control of the air—which gives him control of the sea—may land air forces from airplane carriers on any of the islands or keys along our coast, which cannot attack by troops or artillery, and from those points launch air attacks against our great centers of population, extending even to Chicago, St. Louis and other Middle Western cities."

The report then explains how Chicago, St. Paul, Omaha, Kansas City and other cities in the Central West would be laid open to airplane attacks and their cities bombed with high explosives and the citizens killed with gas and incendiary bombs.

Makes Four Recommendations

In conclusion, General Mitchell makes the following recommendations:

1. The establishment of an air force for frontier and coast defense.
2. The equipment of the navy for offenses on the high sea, and not for coast work.
3. Navy control should cease 200 miles from shore, protection of the land and the coast defenses being left to the army and the air service.
4. A more co-ordinate and working understanding between the different arms of the service. The present system, a heritage of our early wars, has clearly demonstrated that the present lack of cooperation is a serious fault.

"In this connection," the report states, "an efficient solution of our defensive needs will not exist until a department of national defense is organized with a staff common to all services. Subsecretaries for the Army, the Navy and for the Air Service must be created."

A Letter

EDITOR, AVIATION AND AIRCRAFT JOURNAL:

Your attention is invited to a serious error in the article entitled "The World's Airship Types in 1921", by Mr. d'Orcy and published in your issue of Sept. 5, 1921.

Under the heading 'American Airship Types" the non-rigid airships are referred to as "Goodyear type". The airships built by the Goodyear Tire and Rubber Co. for the Navy Department were built to designs prepared by the Department with the exception of the E-1, F-1 and H-1. The latter was an experimental type designed and built by the Goodyear Co. to a general specification prepared by the Navy Department. The letters B, C, D, E, F and H were assigned by the Navy Department and are the Navy Department types. These airships should accordingly be referred to as "Naval Type Airships" constructed by the Goodyear Tire and Rubber Co.

J. C. HUNSAKER

In addition the writer of the article in question wishes to point out that according to revised information the American rigid airship Z.R.1 now under construction by the Naval Aircraft Factory to the designs of the Bureau of Construction and Repair, Navy Department, will closely follow the dimensions and capacity of the German L.49, namely, 643 ft. length, 79 ft. diameter, and about 1,950,000 cu. ft. capacity. The power plant will probably consist of six Liberty engines reduced to 320 hp.

The Huff-Daland HD-4 Training Airplane

Among the aircraft manufacturing firms which have come into existence since the armistice Huff, Daland & Co., Inc., of Ogdensburg, N. Y., deserves special mention for the numerous original and up-to-date ideas it has incorporated in the design of its machines. This firm has so far produced two distinct types of airplanes involving several models to each type; the HD-1, or "Early Bird", and the HD-4, or "Bridget", while the construction of three more types, including a flying boat ,is either under way or about to be undertaken.

While this article is mainly concerned with the description of the HD-4B training airplane a brief description of the first product of this firm, type HD-1, will also be of interest. This latter machine is a commercial type made in two models, A and B.

The HD-1A is a three-seater with two 80 hp. LeRhone engines, which with a weight of 2260 lb. give a power loading

TOP: THE HUFF DALAND HD-1A
BOTTOM: THE HUFF DALAND HD-1B

of 14.1 lb. per hp. The machine carries a useful load of 740 lb. and fuel for 2 hr. with a speed range of 45 to 90 m.p.h.

The second model of the type HD-1 is the HD-1B. This machine is a 5 seater with two 100 hp. Anzani engines, which with a weight of 2850 lb. give a power loading of 14.1 lb. per hp. The machine carries a useful load of 1100 lb. and fuel for 2 hr. with a speed range of 48 to 90 m.p.h.

To revert to the HD-4 the training model of this type is known as the HD-4B. In the design of this machine much thought has been given to the elimination of as many complicated parts as possible by the substitution of a few substantial engineering features. The result is a machine of quick and low cost production by a force largely of unskilled labor.

A few of the more important features of construction are worth special mention. The elimination of wires in the wing trussing, substituting in their stead adjustable wood and steel struts has resulted in ease of alignment and assembly, together with a reduction in spare parts such as turn buckles, ferrules, etc.

The fuselage is so designed that the tail loads and wing loads are carried by direct paths through rigid struts in place of the usual struts and wires. This greatly reduces the number and weight of parts and increases the speed of assembly. The few wires which are necessary are threaded directly into universal ends thus eliminating approximately 300 turnbuckles.

The rigid center section struts afford protection to the pilot and passenger in case of the machine turning over, the upper wings being held in position and supporting the weight of the fuselage.

Streamlining is done by linen with the exception of the veneer sides and the parts around the engine. This saves both weight and expense.

The tail plane is adjustable while the machine is on the ground and permits of the balancing of the machine at varying load.

The most important single feature is the hinged engine mounting permitting of the inspection and adjustment of the carburetors and magnetos without breaking any of the control or supply connections.

The use of Imber leak-proof tanks for both gravity and main supply practically eliminates danger from fire. These tanks are removable and open to inspection by swinging the engine and opening the fire shield compartment.

The engine cowling is aluminum built in straight sections for production and thus greatly reducing the cost while but slightly increasing the head resistance in flight.

The landing gear is of simple steel tube construction made up without welding or brazing. Without any change in the gear as supplied with the machine provision is made for the attachment of forward skids or hydrovanes. The landing gear is high enough to permit the use of a 9 ft. propeller.

Dual control is provided with the possibility of introducing a flexible connection in the student's control to permit the instructor to take full control at any time.

The wings fold back from the 8 ft. center section and thus permit the storage of the machine in a small space.

Only four different lengths of No. 10 wire are used on the machine, only three sizes of steel tubing, two diameters of bolts, and two thicknesses of cold rolled steel.

The pilot and student are located sufficiently back in a single cockpit to permit ready exit in case the use of parachutes becomes necessary.

Detailed Description

The Fuselage, The fuselage is of built up, trussed, veneer and linen covered type, 18 ft. in length from tail post to fire shield, 3 ft. 6 in. in depth, and 2 ft. 9 in. in width. Veneer 1/8 in. in thickness is used to cover the sides and bottom from the fire shield to a point aft of the rear seat. The triangular construction of the fuselage carries the stresses directly to the wing girders and maintains a rigidity of construction which is noteworthy. This construction facilitates production and eliminates all fuselage fittings. The loads from the tail skid and controls are carried directly from the stern post to the upper and lower longerons thus practically eliminating all shearing forces in the rear portion of the frame. The forward portion of the fuselage has an additional system of triangular bracing to take the landing gear and passenger loads. Veneer sides and suitable struts are provided to take the stresses imposed on this section. The internal wires are in the plane of the lower longeron only. They are round wires threaded on the ends and carried through holes in the longerons at the strut stations to a small steel plate and nipple. The length of the fuselage bays is such that wires of the same length and diameter as those on the wings may be used.

The Wings, The wing section employed is the R.A.F.4 propeller section, which has characteristics similar to the R.A.F.15 with slightly better *L/D* values, and permits the use of deeper spars due to the double camber. The characteristic feature of the wing structure is its wireless construction. The wireless construction is obtained by replacing the usual flying and landing wires by flying struts which act as compression members during landing and upside down flight. These struts in the long bays are of unusual design. They are designed for upside down flight with a safety factor of 4. They are built of two streamline 4 to 1 sections 7/8 in. thick and spaced 5 in. apart on centers, the halves being braced together by transverse blocks coweled and glued to the struts.

The struts in the inner bays are steel tubes calculated as long columns. The drag bracing in the wings is of swaged wire. The drag struts are of the box type made up from standard rib webs with ¼ in. spruce cap strips between the webs.

Controls. The controls are of the dual stick type. The tail plane is adjustable while the machine is on the ground, and the rudder and tail skid are interconnected for ease in taxiing. Control cables are of ⅛ in. stranded cable. The pilot's control stick is provided with a yoke at the lower end which straddles a fore and aft shaft carrying the aileron quadrant at a point just over the lower rear wing spar. The student's control stick is attached to this fore and aft shaft by means of a yoke, and is connected to the pilot's controls by means of a rod. The rudder controls are duplicated.

The Tail Unit, The tail unit consists of an adjustable tail plane, an elevator continuous across the machine, two vertical fins integral with the fuselage sides, and a balanced rudder. The tail plane is mounted on either side of the fuselage, and its rear beam forms the tail post for the fuselage.

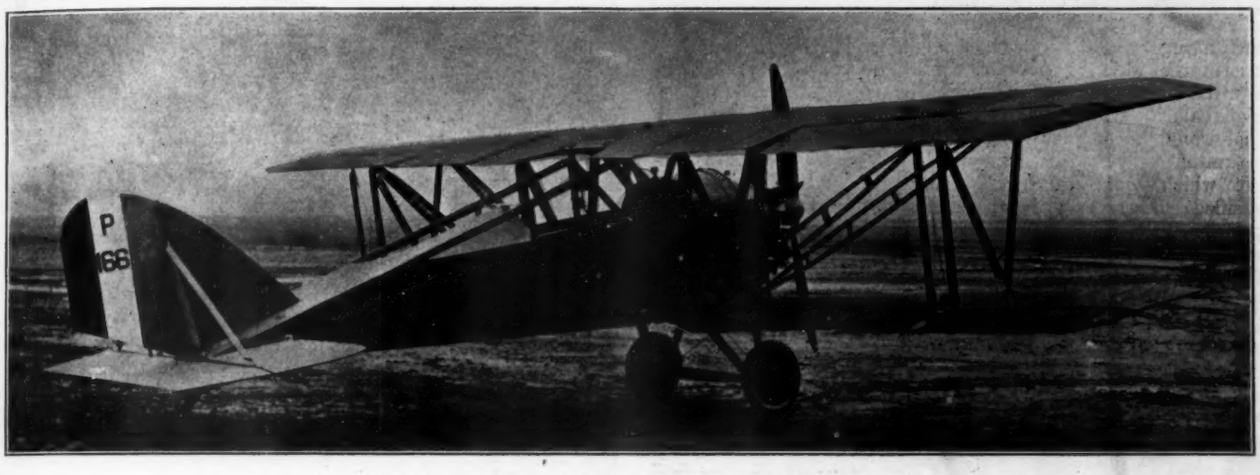
The Engine, The engine is a Lawrence Model R of 150 hp. with the following specifications:

Number and type of cylinders	9, air cooled
Bore	4.5 in.
Stroke	5.25 in.
Piston displacement	675 cu. in.
Compression ratio	5.2:1
Normal hp.	150
Normal r.p.m.	1600
Fuel consumption	.45 lb. per hp. hr.
Oil Consumption	.035 " " " "
Weight, dry	400 lb.

The engine is bolted to a circular nose piece which is supported by a system of trussing consisting of metal tubes connected directly to the four longerons at the forward bulkhead. This mounting is such that the engine may be swung to one side for purposes of inspection and minor overhauls. Engine controls are dual and located on the port side of each cockpit.

Fuel and Oil Systems, The fuel system is of the pump feed gravity type and consists of a 30 gal. main tank, a 6 gal. gravity tank and a fan driven gear pump. The main tank is located directly aft of the forward bulkhead and between the engine and the pilot. The tank is protected by a fire shield. The gravity tank is cylindrical and is located just over the main tank. Both these tanks are of the Imber fire proof type the construction of which is interesting. The interior frame work which supports the shell is made of aluminum tubing to which longitudinal and transverse baffle plates are secured by means of metal clips. The framework is inserted into the terne plate shell but in no way are the two connected. The frame work simply acts as a support for the shell. Over the shell is a coating of fine grade rubber ¼ in. thick. This rubber entirely covers the tank and is vulcanized by a steam pressure of 30 to 40 lb. per sq. in. for 75 minutes. All blistering and air holes are eliminated while at the same time there is no adhesion between the shell and the rubber covering. All corners are reinforced with lattice strips. The tank is mounted in a hammock of fine mesh aluminum wire which is suspended from the longerons. Between the wire and the rubber covering is a layer of felt to protect the rubber from the wire.

The fuel pump is of the gear type operated by a wind vane, and is mounted on the left side of the fuselage well in the slip stream. Fuel is forced from the main tank to the gravity tank by means of the pump. A check valve between the pump and the gravity tank prevents the fuel from running back and thus, at the same time, keeps the pump constantly primed. Two outlets lead from the gravity tank to the carburetors thus providing for the flow of fuel should one pipe become stopped. The fuel passes through a strainer on its way from the gravity tank to the carburetors. All fuel piping is ⅜ in. x 20 ga. seamless copper tubing. Joints are made through brass tail pieces with ground union faces silver soldered in place except in the case of the flexible hose where the connection is made by clamps.



THE HUFF DALAND HD-4B TRAINING AIRPLANE

The oil tank is suspended from the engine bearers and so constitutes a unit with the engine. Cooling is obtained by louvres in the motor cowling which permit air to flow around the tank. The oil pipe is ⅝ in. x 20 ga. seamless copper tubing. All connections are made direct by tail pieces with ground union faces.

The Landing Gear, The landing gear is V type constructed of steel tubes which support an axle through rubber shock absorbers. The metal struts are attached to the lower longerons at the forward bulkhead, engine mounting, and front wing spar. Fittings are provided for the attachment of a hydrovane or forward skids in case it is considered advisable to employ emergency flotation gear. The axle is of steel tubing and the struts are streamlined with balsa wood and wrapped with linen.

The machine has been tested at McCook Field by the Army Air Service but details of its performance are not yet available. The specifications, however, are as follows:

SPECIFICATIONS

Span,	37 ft. 6 in.
Chord,	
Upper Wing	6 ft.
Lower Wing	4 ft.
Gap	5 ft.
Length	23 ft. 6 in.
Height	8 ft. 6 in.
Dihedral,	
Upper Wing only	2½ deg.
Incidence	2 deg.
Stagger	18 in.
Aspect Ratio,	
Upper Wing	6.25 to 1
Lower Wing	9.4 to 1
Weight empty	1266 lb.
Weight loaded	1906 lb.
Useful Load	640 lb.
Engine and Power	Lawrence, 150 hp.
Power Loading	12.7 lb. per hp.
Wing Loading	5.3 lb. per sq. ft.

The Problem of Fuel for Aviation Engines *

Four main factors must be considered in the choice of a fuel for aviation engines: (1) composition, (2) quantity available, (3) price per heat unit, and (4) facilities for maintaining stocks at aerial ports. Consideration must also be given to the engine modifications required by a change in fuel; and the problem of carrying the fuel aboard aircraft and supplying it to the engine.

Fuel in the gaseous form cannot be considered on account of the space occupied by, and the weight of the container for, such a fuel. Solid fuels which might be pulverized, or which are in the form of powder, cannot be considered although liquefiable or soluble fuels might be used. Liquid fuels of high calorific value per unit of weight are best. An ideal fuel would be of such a nature that it would not evaporate instantaneously in free air, or at least would not form a mixture which would ignite easily, but which could be mixed and gasified satisfactorily in the carburetor and would form a sufficiently inflammable mixture in the engine cylinder. These conditions have not yet been fulfilled by any of the existing fuels for internal combustion engines.

When considering the fuel mixture it is especially important that any possibility of the separation of the fuel and air either in the manifold or cylinder, should be eliminated. There are two fundamental ways of doing this: by (1) fine atomization at all loads and speeds, and (2) vaporization of the whole or the main part of the fuel.

For liquid fuel the vaporization is best done after the fuel has left the nozzle of the carburetor at which time it is surrounded by the air for combustion which must also supply the heat for evaporation, when there is no heating of the carburetor or manifold.

Two methods may be employed in the use of fuels with high boiling points, either or both of which may be applied separately or simultaneously; (1) fine atomization of the liquid at all loads, and (2) increase of the temperature of the fuel mixture and the surrounding walls above the saturation temperature of the fuel-air mixture. This increase in the temperature of the mixture and walls is difficult when starting the engine cold as it requires time to obtain heat from some source and transfer it to the mixture. The most convenient method is to start with a fuel of low boiling point and run until the desired temperatures are obtained.

Tests of the possibility of utilizing fuel with a high boiling point by means of injection into the combustion chamber with compressed air atomizers show the operation of the engine to be least reliable when injection was completed just before ignition.

At present too little is known about premature ignition to enable a clear and unbiased judgment as to its cause to be given. Experience shows that totally different degrees of compression are necessary in the same engine for different fuel mixtures. The risk of premature ignition decreases as the weight of charge is reduced although the compression ratio which determines the temperature at ignition and the composition of the mixture are not thereby altered. Experiments show benzol and alcohol generally to be far less inclined to premature ignition than gasoline. Petroleum and gas oil, for which the temperature must be raised when they are utilized, possess particularly low spontaneous combustion temperatures so that there are two reasons for using a low compression ratio with these fuels.

An essential provision for the safe operation of engines with prepared fuel mixtures ignited in the engine by means of a special ignition pin is that the compression temperature should remain far lower than that of spontaneous ignition under all conditions.

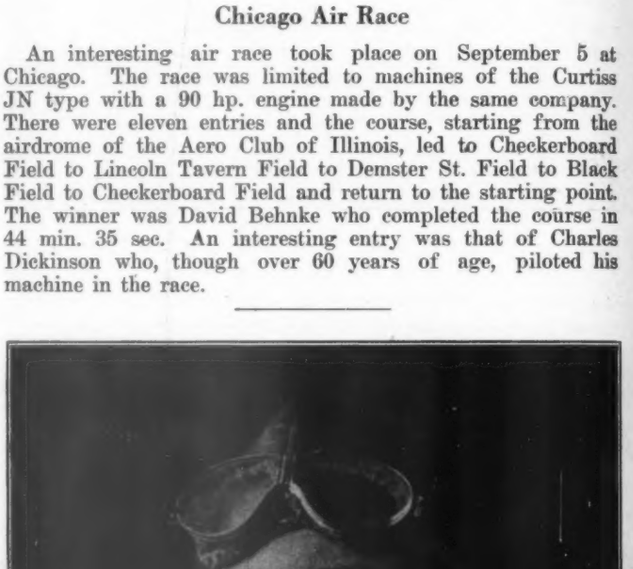
Ignition velocity plays an important part, especially in high speed engines, and is as yet insufficiently understood. As the ratio of air to fuel increases the ignition velocity first increases slowly; then, in some cases, as with ordinary gas, increases rapidly, while in others, especially with gasoline and benzol, it decreases slowly.

Consideration of the various aspects of the fuel question leads to the conclusion that the combustion type of engine should not be used for aviation or light automobile engine designed for the use of fuels of high boiling point. Rather should the aviation engine be selected from the ignition engine class with the best possible atomization and comparatively low compression ratio. With this in view, a systematic investigation should be made of all the important characteristics of fuels, so that the heavy-oil aviation ignition engine may reach the same stage of development which distinguishes the best light-oil ignition engines from all other combustion engines, namely; (1) a gasoline consumption of 0.04 to 0.42 lb. per hp. hr., (2) a mean useful pressure of 128 to 142 lb. per sq. in., and (3) a power loading of 1.8 to 3.3 lb. per hp.

* Abstract of a translation by the Paris Office of the N.A.C.A. of a lecture given by Professor Kutzbach, Scientific Collaborator of the Adlershof Aeronautical Laboratory, at Dresden. N.A.C.A. Technical Note No. 62.

Chicago Air Race

An interesting air race took place on September 5 at Chicago. The race was limited to machines of the Curtiss JN type with a 90 hp. engine made by the same company. There were eleven entries and the course, starting from the airdrome of the Aero Club of Illinois, led to Checkerboard Field to Lincoln Tavern Field to Demster St. Field to Black Field to Checkerboard Field and return to the starting point. The winner was David Behnke who completed the course in 44 min. 35 sec. An interesting entry was that of Charles Dickinson who, though over 60 years of age, piloted his machine in the race.



Lt. Col. Harold B. Hartney, Recently Appointed Executive Secretary of the Aero Club of America

An Analysis of Aircraft Accidents *

Based upon the most trustworthy available information, it is estimated that 1,200 aircraft are engaged in commercial flying in the United States today. It is believed conservative to estimate that these craft flew a total of 3,250,000 miles from Jan. 1 to June 30, 1921.

One of the severest handicaps to the normal development of transportation by air is the belief that it is extremely dangerous. This belief is strengthened by the knowledge that no laws or regulations governing such traffic exist, and is further increased by the extraordinary publicity which is given each flying accident, military, naval, postal or civil.

Lack of Official Machinery

In preparing an analysis of the safety of flight, the Association has met with the primary obstacle—the lack of official machinery with which to obtain thorough and authentic information, due, in turn, to the lack of an Aerial Code. This consequently must continually be borne in mind, as voluntary reports to this Association, or accounts clipped from newspapers, may or may not be reliable. Nevertheless, we have endeavored to get the most out of the material at hand.

Our tabulation shows that, in the first six months of 1921, there were forty serious accidents in civil flying, not including accidents to Government-owned machines. Two of the forty disasters occurred in January, one in February, two in March, six in April, sixteen in May and thirteen in June—progressing as the flying season advanced. The accidents were reported from all parts of the United States.

The forty accidents resulted in death to fourteen persons and injury, more or less serious to fifty-two. In eighteen instances there were no casualties. The fourteen lives were lost in ten accidents, and injury to the fifty-two persons was caused in twenty accidents.

Requisites for Safe Flying

Before proceeding further with the analysis it must be stated that, in safe flying, there are the following requisites:

1.—A machine sound, aerodynamically and structurally.
2.—An engine of sufficient power and which operates satisfactorily.
3.—A competent, conservative pilot and navigator.
4.—Air ports and emergency landing fields, sufficiently close together to insure gliding to safety.
5.—Nation-wide weather forecasts specialized and adapted to the needs of fliers.
6.—Nation-wide chart of air routes.

Accidents Attributed to Pilot

Each of the forty accidents recorded was caused by deficiency in one or more of the above elements. Seventeen were attributed to the pilot, perhaps through carelessness, perhaps incompetence, perhaps bad judgment combined with other factors. There is no doubt that a good pilot can guide a poor machine to safety with greater chance of success than a poor pilot can operate a first-class craft. Therefore, at the very top of the list of Governmental needs we place the examination and licensing of pilots. During the war rather more than 17,000 young men were trained to fly. The art of flying can not be retained perpetually without practice, nor can it be maintained at a high degree of competency without regular examination. The same is true of aerial navigators. Both pilot and navigator (many times they are identical) are of equal importance in safeguarding the lives of travelers by air.

Inadequate Landing Fields

Ten accidents are attributed to inadequate landing fields or to the total lack of landing facilities. Here is a duty directly imposed upon the Federal government. During the war the Army and the Navy acquired many terminals, most of which have since been abandoned. The fragmentary remainder has been slightly added to by the Air Mail, municipalities and private enterprise, but the United States is today woefully lacking in air ports for even the 1,200 craft in operation. A survey made by this Association discloses that, in the United States and its possessions there are only 271 land and water air terminals, many of which are concentrated in certain localities. Of the 271 listed air ports, 145 are controlled by municipalities, 69 are privately owned, and the others are a part of the Army and Navy air services, and the Air Mail.

What a terminal is to a railway and a harbor to a steamship line, an airport is to an aircraft company. Safety in flight can not be approximated until a central authority specifies air ports of different grades and classifications and then requires that each be maintained accordingly. Thus there will be land or water ports or terminals of the first class for New York, Chicago, etc.; second class for places of minor importance, third class, etc., and a system of emergency fields, or water locations upon which aircraft can alight in emergency.

Lack of Weather Reports

While only two accidents are attributed to the lack of weather reports and two to the lack of clearly defined routes or limitations in traveling between or over cities, it is certain that aerial transport can not develop until these factors are met. As an illustration--two of the worst accidents in our flying history are attributed to these causes. As one was naval and the other military, they can not be included in the civil table ,though in their results they were as harmful to civil flying prospects as though they had occurred to private individuals.

On March 2, a naval seaplane, according to press reports, sideslipped on to a beach near Pensacola, Fla., and killed five bathers. Either the seaplane had no business over that beach or the bathers had no business on it. In either event, the fatalities would have been prevented had proper authority existed.

On May 28 a large Army plane crashed at Morgantown, Md,, killing its seven occupants, who included some of the best-known figures in military and civil aviation. According to the report of the Inspector General's investigators, the disaster was not due to defects in the machine or to incompetence on the part of the pilot, but to the terrific storm into which the ship flew and of which the pilot had not been warned. The investigators above referred to recommend that "steps should be taken to install a system for interchange of weather conditions and weather forecasts, between flying fields maintained by the various services, including Army, Navy, Mail Service and Coast Guard Service." It was further stated: "Obtaining information of weather conditions on a cross country flight ranks in importance with the inspection of the engine and plane; and it is highly desirable that, in peace times, except in emergencies, no cross country flights should be undertaken until available information of conditions on the way has been obtained."

Commercial cross-country or inter-city flights, it is evident, can not be encouraged with safcty until there is full protection afforded by establishing civil weather reports and co-ordinating these with the various Government reports.

Inspection an Imperative Need

Equal in importance with learning the qualifications of pilot and navigator is inspection of aircraft and engines. Out of the forty accidents, eleven may be attributed to faults which proper inspection probably would have revealed—three concerning the plane, six the engine and two an accessory. In many instances it is found that the engine is blamed when really it is an accessory that is at fault. An analysis of the Pulitzer Race last year proved this.

When it is remembered that operators of motor cars are required to qualify and that motor cars are periodically placed under rigid inspection, it is astonishing to learn that *anyone* can take *any* sort of flying machine into the air at the present

*Prepared for the Secretary of Commerce, by Information Department, Manufacturers' Aircraft Association, New York City.

time, with the consequent peril not only to himself and his passengers but to many persons below.

In one accident attributed to the attempt of the pilot to stunt an unsafe machine, two lives were lost. An investigator reported that the plane was not a factory-maintained product. He said: "It was one of the Army training types which had passed through many owners and which, my investigation shows, had been in at least four crashes previous to the final one. One of these accidents occurred at Monticello and two at Liberty, N. Y. I found that the machine had been repaired by amateurs, that several of the spars and longerons were patched, some of them in four places. It was the giving way of these spars that undoubtedly caused the wings to collapse. The plane had lain out of doors in the open field all winter and one windstorm had blown it the full length of the field—about 1,000 yards—and turned it over end. This spring it it had been hauled back to its original position and put together again as best as might be. It was never inspected by a competent person, so far as I was able to learn. I found that the owner of the flying field—who is also a flier—had himself refused to fly this machine when the young man who took it up on its fatal trip was induced to become the pilot."

In the lack of any Governmental examination and inspection, the legitimate manufacturers and operators have endeavored to do what they could . They check up their products, but their control is of necessity limited to localities and to a comparatively brief period of time. As flying increases, this method must become more hopeless and a stern responsibility is thus placed upon the Federal government to provide an adequate system of examination and inspection.

Stunting Causes One Half of Accidents

Eight of the forty accidents occurred during stunting. In these eight accidents—seven persons were killed and twenty-six injured—exactly 50 per cent of the total. In other words, stunt flying in unrestricted areas was responsible for as many casualties as all other elements combined. Now stunt flying is necessary to testing and essential to warfare. It is believed advisable that all pilots know *how* to stunt so that, in case of an emergency, when *only* a stunt will save their craft, they will be able to act quickly, with understanding and without fear. But the habit of stunting for thrill is dangerous, fatal in many instances, and always harmful to civil flying. A Governmental system of control, limiting stunting to certain areas will meet this unfortunate menace to aeronautics. In this connection, however, there is hope of general improvement. State Fairs and other amusements, since the war, have encouraged dare-devil flying as "concessions". But after stunts had killed many people and injured more under spectacular circumstances (such as collisions with grandstands, crashes on beaches, etc.) the New York State Fair Commission, according to press reports, eliminated the dare devel aerial acrobat from its list of attractions.

Collision in the Air

The danger of collision in the air is not great, providing levels of flight for aircraft under way are established and observed, and providing stunting is controlled. The only collision reported occurred during a stunt performance, it resulted fatally.

Crowds Surge on to Field

Two accidents are reported through carelessness on the field. In one notable instance the pilot, in order to avoid the crowd which surged out in front of his machine as he was taking off, deliberately wrecked his craft. It is observed that at every flying demonstration, even at locally policed fields, the spectators ignore warnings and must be forced to keep back. This is illustrated by the long list of automobile race track casualties, where spectators got in the way. Only federal rules rigidly enforced are able to meet this condition.

Searching for the "Unknown" Cause

Finally, five accidents are attributed to "unknown" causes. The hope of preventing accidents depends on learning—then correcting—the cause of each. It is evident that Government authority is required to obtain information in such cases.

Flying, Regulated, Is Not Unsafe

From the foregoing it would seem to appear that flying is unnecessarily hazardous. As a matter of fact, flying, properly controlled and regulated is not unsafe. Even the present records show but one fatality for each 232,142 miles flown, and one injury for every 62,500 miles flown. The civil equipment in use consists almost wholly of former war machines, built from two and one half to three and one half years ago. With more modern equipment, specially designed and built for commercial use, and with Federal control of operation, the casualty record can be very greatly reduced and civil aerial transport thus placed upon a safe and sound basis, attracting both patrons and investors.

RECAPITULATION OF AIRCRAFT ACCIDENTS
Jan. 1 to June 30, 1921

ACCIDENTS DUE TO		NUMBER
Piloting		17
Poor fields or lack of them		10
Lack of weather data		2
Lack of route data or flying limitations		2
Inspection	faulty craft	3
	faulty engine	6
	faulty accessory	2
Stunting		8
Collision		1
Carlessness on field		2
Unknown		5
Total number of accidents		58
Accidents entailing casualties		40
Number of fatalities		14
Number of injured		52
Accidents entailing no casualties		18

British Air Secretary Arrives

Captain F. E. Guest, British Secretary of State for Air, has arrived in Washington, for the purpose of extending the condolence and sympathy of his government to the United States Navy on account of the loss of life of American personnel in the destruction of the R-38. Captain Guest and Air Commodore Charlton of the British Embassy were the guests of the Secretary of the Navy at luncheon on board the "Sylph" at noon today, the other guests being the Assistant Secretary of the Navy, Col. Roosevelt, Admiral W. A. Moffett, Chief of the Bureau of Aeronautics, and Captain D. F. Sellers, Aide to the Secretary.

The Secretary of the Navy calls attention to the fact that the visit of Captain Guest recalls the narrow escape of the British Air Minister. Captain Guest having cabled from London asking permission of the Navy Department to cross the ocean in the R-38, which permission was granted, he would have been aboard her at the time of her destruction had not the sailing been postponed from week to week, and his mission compelled him to leave Britain before the ship had her trial. Had it not been necessary for him to leave earlier he would undoubtedly have been aboard the R-38 on her trial trip.

Secretary Denby's Seaplane

A seaplane, constructed at the United States naval aircraft factory at the Philadelphia Navy Yard for the use of Secretary Denby of the Navy Department, has made its initial flight and passed its tests. The flight was made by Lieut. A. C. McFall, flight test officer at the aircraft plant.

The craft is a standard seaplane of the F-5 type, modified to allow greater comfort and more ample passenger accommodations than the ordinary. It was constructed at the request of Secretary Denby and will be flown to Washington, where it will be kept for his use.

St. Louis Aircraft Firm Moves

The Robertson Aircraft Corp., due to an increased volume of business have moved into larger offices at 5249 Oakland Ave., immediately opposite the St. Louis Municipal Airdrome in Forest Park, which is the Air Mail Field at St. Louis. The company, in addition to maintaining its flying school, deals in all manner of airplane equipment and supplies, and is in a position to give service to machines landing at the St. Louis Field.

Two New Hanriot Airplanes

While the Hanriot airplanes are probably less well known in this country than any other French make, principally because they were not used during the war on the Western front, American pilots having seen service on the Italian front will remember the Hanriot pursuit machine which was largely used by the Italian air service. Since the Armistice the Hanriot firm has produced a ship's plane which has been adopted by the French navy for deck flying and now our contemporary *L'Air* announces the completion of two new Hanriot types, the HD-15 and the HD-18. Both machines are single-engined tractor biplanes, and embody thick wings and duralumin construction throughout, with the exception of the covering of wings and fuselage, which are of fabric.

The Hanriot HD-15

The Hanriot HD-15 was designed to answer the requirements of both pursuit and corps observation, for which reason it combines high speed (142 m.p.h.), good maneuverability and a sufficient cruising radius (4 hr.). The engine, a 300 hp. Hispano Suiza, is fitted with a Rateau supercharger which enables it to maintain its full power output up to 16,500 ft., whereby the speed at high altitudes and the climb are greatly improved.

As may be seen from the specification table, the useful load is unusually high for the total weight loaded, amounting to slightly under 43 per cent, which is remarkable for a high performance machine. The constructor attributes these features mainly to the duralumin construction whereby a considerable amount of dead weight was saved, and also to the high lift/drift characteristics of the thick wing adopted.

The framing of the wings is entirely composed of duralumin members, there being a main spar with two secondary spars of duralumin tubing, while the ribs are built up in the form of lattice girders from flanged duralumin strips. The interplane truss is unusual, being similar in principle to that used on the Brandenburger "star-strutter" built by the Austrian Phoenix works during the war. Each wing cell is interconnected by four streamlined duralumin tubes which all meet in a common point half way between the wings, thus forming what may be described as a double Warren truss.

With a view to facilitating production, the wings are of square plan shape and have equal dimensions, without dihedral or stagger.

The fuselage is built up of round duralumin tubing. The longerons and cross pieces are assembled by means of collar joints, the vertical cross-pieces forming a Warren truss which eliminates the necessity of wire bracing. The fuselage thus does not require any aligning, being indeformable.

The tail unit consists of a tail plane and elevator, and of a vertical fin and rudder. The framing is of duralumin.

The landing gear is of the V type, consisting of duralumin struts joined by steel sockets. The two V's are connected with one another by two duralumin tubes to which a divided axle is hinged. This is sprung from rubber cord shock absorbers which are wound around quick detachable spools. These are duralumin castings. The tension of the shock absorbers may be adjusted on the field by means of threaded guides.

The controls are of the stick and foot bar type.

CHARACTERISTICS OF THE HANRIOT DH-15

Span, 37 ft. 7 in.
Length overall, 25 ft. 2 in.
Chord, 4 ft. 7 in.
Gap, 5 ft. 7 in.
Wing area, 260 sq. ft.
Engine, 300 hp. Hispano-Suiza.
Fuel capacity, 4 hr.
Weight empty, 2035 lb.
Useful load, 1595 lb.
Weight loaded, 3630 lb.
Maximum speed at 23,000 ft., 142 m.p.h.
Climb to 23,000 ft., 20 min.
Theoretical ceiling, 33,000 ft.

The Hanriot HD-18

The Hanriot HD-18 is a combination type which may either be used as a day bomber or as a long range (strategical) observation airplane. Fitted as a day bomber the HD-18 carries 880 lb. of bombs and 4 hr. fuel, while for long range observation the bomb load is replaced by additional fuel tanks which increase the range to 8 hr. The protective armament consists in either case of twin Lewis guns mounted on a tourelle in the rear.

The crew consists normally of three men, namely, the pilot, the navigator, who sits next to the pilot on a collapsible seat, and the gunner in the rear cockpit. A radio set is mounted on a sliding board in such manner that it may be used either by the navigator or, if none is carried by the gunner, in which case the set may be slid back to the rear cockpit.

While the constructional features of this machine are in a general way similar to those of the HD-15, the HD-18 differs from the former in several details. Particular attention has been paid in this design to quick dismantling and interchangeability. The wings, upper and lower, are of equal span, and consist of three sections connected by means of articulated joints. Each section is 19 ft. long, and is built up on two wing spars.

The interplane struts consist for each cell of two pairs of vertical struts which are fastened to the two wings spars by means of articulated fittings. These fittings are duralumin castings. The interplane struts are fitted with an adjusting gear.

The fuselage can be quickly dismantled into two sections. In the front section the duralumin tubes of the framework are joined by steel collars, while in the rear section welded lugs are used for this purpose.

The engine is a 300 hp. 12 cyl. water cooled Renault, and is fitted with Lamblin radiators.

The landing gear consists of two following V structures carrying four wheels, the details of which are identical with those found on the HD-15.

CHARACTERISTICS OF THE HANRIOT HD-18

Span, 43 ft. 3 in.
Length overall, 31 ft. 4 in.
Wing area, 392.5 sq. ft.
Engine, 300 hp. Renault.
Weight empty, 2200 lb.
Useful load, 2712 lb.
Weight loaded, 4912 lb.
Maximum speed at sea level, 105 m.p.h.
Speed at 5000 ft. (service ceiling), 100 m.p.h.
Ceiling, 18,000 ft.

Airdrome Notes

Victoria Beach, Man., Ca.

The Canadian Air Board has established under license number 47 a commercial seaplane station at Victoria Harbour, this city. Water available for landing extends about 800 yd. in length and the station is marked with a triangle.

Ottawa, Ca.

The Canadian Air Board announces the cancellation of Airharbour License No. 24 held by W. N. Deisher for a commercial airdrome on Bowesville Rd. adjoining the Ottawa Hunt and Motor Club 6 miles S.W. of Ottawa and marked with a triangle enclosing a right-angled cross.

Fokker Passengers

Since its arrival in this country late in July the Fokker F3 monoplane, the "Half Moon", has carried over 700 passengers. The machine, piloted by Bert Acosta, has been flying at Hazelhurst Field, L. I., N. Y., Camp Vail, N. J., Washington, D. C., and Hartford, Conn. During all this passenger carrying the fuel consumption of the Fokker has been at an average of 8 gal. an hour.

Change in Name

At a recent meeting of the Board of Directors of the Radium Luminous Material Corp., 58 Pine St., New York, who have been active in the production of luminous materials for aircraft instruments, the name of the concern was changed to the United States Radium Corp.

Airships for a Transatlantic Service

By Ralph Upson

Trans-oceanic travel, is not only the most attractive field for practical airship development, but it also furnishes the most interesting scientific comparisons, for airships and steamships are both displacement types of vessels subject to the same fundamental laws. Hence, our first effort will be directed toward various factors common to both, from which direct analogies can be drawn.

Resistance: The ultimate end of nearly all fluid resistance is in heat developed by the viscosity of the fluid, but in its immediate effect on the vessel it may be conveniently divided into three parts:

1. Skin friction, or that caused by frictional drag on the sides of the vessel.

2. Displacement resistance, or that caused by displacing a mass of fluid from its original position and setting it in motion. This item may be further divided into eddy resistance and that due to distortion of the streamlines.

3. Wave resistance, due to the energy expended in forming surface waves.

For properly designed boats and airships at low speed, (1) is the largest. Theoretical considerations, backed by the experiments of Froude, Zahm and others reveal the important fact that the coefficients of skin friction for air and water are almost exactly proportional to their densities for dynamically similar shaps. It is easily proven that (2) follows the same law. This is also backed by experiment. A rough general formula for the first two items would be, Resistance $R = CV^{2-\delta}\,\delta\,v^m + KV^{2-\delta}\,\delta\,v^n$ where v is the speed and δ is the density of the fluid. V is the volume immersed in the fluid, or the displacement in cu. ft. C, K, m and n are constants. The third item of wave resistance occurs only in water and, although important, we will neglect it for the present.

For constant speed and similar shapes using the above formula, the fuel consumption will vary as $HP \propto R \propto V^{2-\delta}\,\delta$. As is well known a floating body must displace its own weight of fluid and this is as equally true for air as for water. Expressed algebraically $W = V\delta$ or $V = W/\delta$.

Substituting above, $HP \propto W^{2-\delta}\,\delta^{1-\delta}$ or for constant weights $HP. \propto \sqrt[3]{\delta}$

as δ for air equals .075 lb. per cu. ft., and δ for water equals 62.4 lb. per cu. ft. The ratio for the horsepower for the two fluids will be $\frac{HP.\ Air}{HP.\ Water} = \sqrt[3]{\frac{.075}{62.4}} = .1063.$

For the sake of simplicity we have used a rather crude formular so that we must now examine the errors involved to see whether the result can be accepted as safe.

First it is impossible to obtain exact dynamic similarity for two different sizes at the same speed, but the condition can be very nearly fulfilled by giving the balloon a blunter contour than the boat, thus increasing its capacity. The fact that a boat displaces water chiefly to the sides is another error in the same direction. The skin friction per sq. ft. is less for a long surface than a short one. Wave resistance which is the most important factor in high speed boats is entirely lacking in the case of airships. It might be said that in water, displacement and wave resistance overlap to a great extent; that is, part of the resistance which is originally in the form of displacement is transformed into waves. But this does not alter the fact that we have excluded a factor of considerable importance. Other errors are variation of the coefficients, and the fact that a small part of the boat is floated by the air.

In examining these omissions we find that all but the last two err distinctly in favor of the water rather than air. After giving everything due weight it appears probable that the result obtained above should be increased a little for low speeds and decreased for high speeds. We are now able to state a law which is of the very greatest importance to the development of aeronautics.

A given weight may be suspended by and *driven through the air at about 1/10 the energy required to drive it as a floating body through water at the same speed.* In other words if we take a boat and, keeping it at the same weight, enlarge it until it floats in the air instead of the water, it can then be driven at about 1/10 the expenditure of power.

Useful Space: Another great economic advantage of the airship and one which would appeal strongly to passengers is that *all the surplus lift may be utilized for first class passengers.* An ocean steamship must necessarily be planned so that only a small part of the total carrying capacity is available for first class cabins. Other less desirable parts of the ship are devoted to second class, third class, steerage, and finally cargo, the latter usually forming by far the greater part. One result of these conditions is that it is found economical to install large and heavy steam engines, and boilers with their large accompanying weight of coal. It is even now maintained that a gain in economy would result from using internal combustion oil engines, but there would be no doubt of it if the space saved could be given over to first class passengers. If this were possible it would pay to spend considerably more on fuel for the sake of an increase in carrying capacity. With an airship the entire hull is surrounded by air, and there is plenty of room all around to put all the passengers which can be carried. There is no portion of the ship where its motion is most pronounced, for there is no appreciable motion. Every particle of weight saved by the power plant or in any other way can be used directly for first class passengers.

No Sea-sickness: The freedom from motion and the consequent elimination of seasickness would be one of the most pleasing prospects of the air route to the average passenger.

The airship will of course have its economic disadvantages, prominent among which are:

1. Its large size compared to the steamship, meaning in general, increased cost. By a comparative calculation similar to the one just made for resistance it may be shown that, using the same materials and an equal reserve of strength, an airship would be approximately ten times as heavy as the equivalent boat. This impossible result is greatly modified by the fact that a boat has to be made to stand the buffeting of the waves and that in a steamship compression members predominate and in an airship tension members.

2. The weight of the hydrogen necessary to secure buoyancy is about 1/14 of the total weight.

3. The expense of the hydrogen. Contrary to popular opinion that is an extremely small quantity compared to the cost of fuel in a large airship.

4. The difficulties of docking, handling ballast, cooling water, etc. These are tremendous problems but consist mainly of engineering detail which there is every reason to believe will be worked out satisfactorily.

5. Wind. This is an item which cannot be overlooked, in fact it *appears to be the critical point in the whole subject.* If it were not for winds we could unhesitatingly recommend the dirigible as a speedier, more comfortable, and more economical method of travel than by ocean steamship. Practically it would require a very profound study of weather conditions over the ocean before starting a regular transatlantic airship line. It is not because winds have any appreciable effect on the stability of the airship (as they have on the steamship) or because they are a cause of accidents in docking, which though important belongs to another heading. The question here is merely how they affect the speed, but this is so important that the success or failure of a trip almost depends on it.

Effect of Wind: In his book describing the first attempt at trans-atlantic flight, Walter Wellman explained the situation very clearly and well. "If a steamship encounters a gale blowing forty miles per hour, as a rule the progress of the ship

is not interrupted. It may be necessary to reduce the speed one quarter or one half, on account of the roughness of the sea, but generally the ship proceeds on her way. If the storm is unusually violent and the sea runs very high, the worst that usually happens is that the ship must lie to for a few hours till the storm's center shall have passed and better conditions obtain, when the voyage is resumed.

"The steamship during such circumstances drifts but a few miles out of her course; she lies to without expenditure of more than enough fuel to keep low fires under her boilers. It makes little difference from which point of the compass the storm blows, and no very serious difference how long it continues. The explanation is obvious; the steamship is affected in its movement and course only to a very small extent by the winds, say one or two or perhaps five per cent, of the force of the wind, regardless of whether the wind is ahead or astern or broadside on. The craft is sailing in the water, not in the air.

"But it is altogether different with the ship of the air. She is navigating the air alone, is a part of the air, and currents in the air exert upon her, not merely one or two or perhaps five per cent of their force, but all of it, one hundred per cent. Thus we find that while the wind means little to the master of a steamship of high power, and considerably more to the mariner of a sailing vessel, to the skipper of a ship of the air it is everything."

General Deductions: Several important facts to be derived from the fundamental mathematics are as follows:

1. A wind blowing at more than 90 deg. to the course is always unfavorable.
2. A wind at less than 90 deg, may be favorable and it may not, depending on its angle and velocity.
3. A wind of very high velocity compared to that of the ship is always unfavorable, except when the angle is 0.
4. If the normal velocity of the ship is less than that of the wind, it can be held to its course only when the wind is from within a certain critical angle which is always less than 90 deg.
5. If the wind velocity equals that of the ship, it will be favorable only when blowing within 60 deg. of the course. From 90 to 180 deg. the ship can be held to its course but there will be no progress.

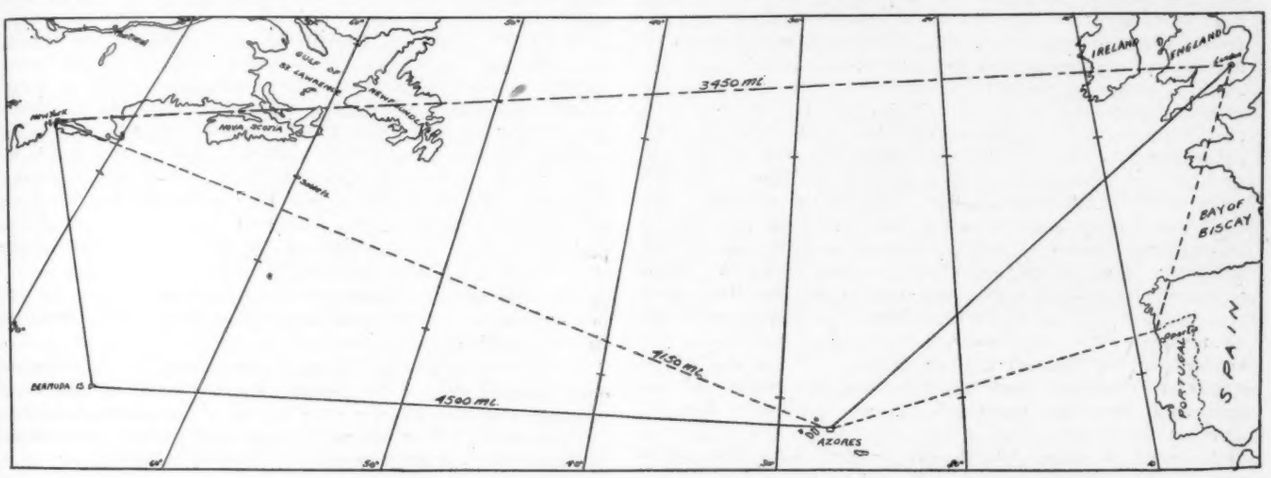
The problem for any particular route involves plotting the prevailing wind currents and changes as accurately as the observed data will allow, applying the results to the laws of chance, and finally to the equations governing the motions of the ship. A very simple illustration will suffice to show the method.

Suppose that on investigating some proposed route we find that the wind always maintains a fairly constant velocity, but changes continuously in direction; that it is equally likely to blow from any point of the compass, and that it is impossible to predict its direction in advance, then if the trip is long enough, we can safely assume that we shall get as much wind from one direction as another. If the normal speed of the airship is made equal to that of the wind under these conditions it can be shown that its true average for the entire trip will be $\frac{2}{\pi}$ or a little less than 2/3 of its speed in still air.

Analysis of a Particular Case: As a practical example, let use assume a route between New York and London by an airship of the following performance:

Length 700 ft.
Diameter, 156 ft.
Volume, 8,000,000 cu. ft.
Displacement, 264 long tons.
Full speed (through air) 54 knots at a brake horsepower of 3200.
Fuel consumption 0.6 lb. per hp. hr.
Lift available for fuel, cargo and passengers, 107 tons, which we will call the "useful load".

The general weather conditions for trans-atlantic flight have been carefully studied using mainly the data collected by Lawrence Rotch and applying it to the performances of the present ship. Detailed tables and charts cover different conditions of which only the general summary is here presented.



MAP SHOWING PROPOSED AIRSHIP ROUTES FROM NEW YORK TO LONDON

Referring to the attached map, the dot dash line shows a direct or great circle flight from New York to London in the general direction of just north of east. Along this particular route is found a greater percentage of winds tending to assist in the east bound flight, with these winds becoming more favorable at higher altitudes. Therefore, the eastward course is chosen along this line at an altitude of 3300 ft., above the sea. In the attached tables it is noted that with full power, an average speed during the winter and summer months of 64 knots can be expected, or the entire trip of 3000 miles can be completed in 47 hr. on a fuel consumption equal to 37 per cent of the entire useful load.

The altitude of the most favorable winds (for east bound trips) is considerably higher than the 3300 ft. here assumed, but cannot immediately be taken advantage of when starting out with a full load. As the trip progresses and fuel is used up, it is possible to go to higher altitudes and thus increase the average speed. Improved speed can also be attained by the pilot's taking advantage of the most favorable atmospheric conditions. In the tables attached no account has been taken of the possibility of better speed at higher altitudes, nor of so plotting the course as to use the actual existing winds to the best advantage. Hence, the figures here given are thought to be conservative.

For the return trip along the same route the minimum of opposing winds are found nearly at sea level. Referring again to the tables it is found that the return trip can be made in a direct line the same as for the east bound trip, but at an average speed of about 48 knots, which means a 63-hr. trip, and fuel consumption equal to about half the useful load. (This percentage could be considerably reduced by stopping

at Newfoundland. Again, by using half power and taking 86 hr. for the trip, the return trip can be made with 34 per cent fuel without even allowing for a possible stop at Newfoundland.

It is found that by taking either of the southern routes shown on the map by the dotted line or full heavy line) the return trip could be made considerably easier. This is due to the fact that this course lies near the region of north east and easterly trade winds whereas the north course lies in the region of prevailing westerlies. Detailed data might be compiled for a southern route, also, but if the westward trip can be completed along the direct route there is a greater margin of safety by taking either of the southern routes. In actual time, the southern route would not save much.

AVERAGE FLYING DATA

	NEW YORK TO LONDON		LONDON TO NEW YORK	
	Half power	Full power	Half power	Full power
Average speed	51 knots	64 knots	35 knots	48 knots
Time required	58 hr.	47 hr.	86 hr.	63 hr.
Fuel required	24 tons	40 tons	36 tons	54 tons
	=22 per cent	=37 per cent	=34 per cent	=50 per cent

Note. These figures are based on average wind conditions (summer and winter) with engines running at full cruising speed of 1000 r.p.m.

Conclusion: Every project will require separate analysis from a meteorological standpoint to determine the expected or average performances. Every *trip* will require separate analysis to determine the best route and other operating conditions to insure best results. The choice of route, altitude, and engine speed in particular will vary for different trips according to the actual weather distribution prevailing at the time.

As this "weather navigation" is effective only with relatively high speed craft, it becomes necessary for reliability as well as time economy to use airships at least double the speed of present ocean steamships. This, together with other factors previously mentioned, makes it inconceivable that the airship will ever be able to carry bulk cargo in competition with steamships. The very favorable hydrodynamic efficiency of the airship (as outlined at the beginning of this paper) does not actually operate toward a direct reduction of costs. But indirectly its effect is two-fold: First it permits units of smaller tonnage for airships than are feasible for steamships, and second, it makes possible for airships the relatively high speeds which are necessary for dependable operation.

Thus the factor which will give the airship a field of its own, in the economics of ocean transportation, can be none other than speed itself. The kind of traffic which it will carry, whether goods or passengers, will be only items to which time is of considerable value. A quantitative analysis shows that the airship will be an economic unit for any cargo whose time is worth $2.00 or more per hour for each tone of weight. As far as freight is concerned this is obviously a very limited field. The vitally interesting fact is that this figure includes all mail and *practically all passengers.*

Oil Prospecting by Airplane

The Imperial Oil Company of Canada has adopted up-to-date methods in travelling to the oil fields in the vicinity of Fort Norman. A party of four, consisting of the pilot, mechanic, a surveyor and a geologist, flying over untenanted and practically unexplored sub-arctic lands, recently made a journey in a J.L. 6 all-metal airplane owned by this company, from Pearce River, Alberta, to Fort Norman, Mackenzie River District, N.W.T., a distance of approximately 1400 miles by river and lake, in 13 hr. and 40 min. flying time. The machine flew on the average around 80 m.p.h., although on occasions with the wind it made a speed of 100 m.p.h. When the aircraft began approaching the foothills of the Rocky Mountains which run down to the Mackenzie River at the mouth of the Nehami, the scenery from aloft was impressive beyond description. Prior to this a snow storm was encountered at Wrigley Harbor, but the plane shot through it without pausing. The tributaries of the Mackenzie River, winding away up into their sources in the mountains, thousands of lakes large and small, and streams were spread out before the vision of the airmen like a map.

By the time the site of Old Fort Norman was reached the machine was flying at an altitude of 4,000 ft. and through the clear atmosphere could be seen the ice shining on the surface of Great Bear Lake, 75 miles to the northeast, and the gorge of the Great Bear River through the Franklin Mountains.

One notable feature of the journey was the making of a forced landing between the far North Forts of Simpson and Wrigley on the surface of the Mackenzie River. The only one around to help the crew in departing was an Indian who had been attracted by the descent.

AIR MAIL OFFICIALS ON AN INSPECTION TRIP. COLONEL SHAUGHNESSY FOURTH FROM THE LEFT

Photo Underwood & Underwood

The editorial below, from the *New York Globe* of Saturday September 17th, is an indication of the understanding and appreciation by the public of the opportunity that is now up to the Secretary of War to place the Army Air Service upon the proper basis for development and usefulness.

General Menoher Resigns

Major-General Charles T. Menoher, chief of the army air service, has resigned, asking to be transferred to field duty in the command of troops. Secretary Weeks has intimated that the resignation will be accepted and the transfer granted.

Official statement has it that General Menoher's action is unconnected with his recent difficulty with the assistant chief of the air service, General William Mitchell. Technically this may be so. Actually it is impossible to believe that there is no connection. General Mitchell is a flier. He is a believer in the great immediate possibilities of aircraft. He has talked and written of these possibilities. He challenged the supremacy of the battleship and jarred congress into arranging bombing tests, which proved that battleships could be destroyed from the air. General Menoher, on the other hand, is apparently a well-drilled West Pointer who believes in discipline as a remedy for most of the ills that men and nations are heir to. He does not seem excited over the possibilities of military aviation. He is not a flier. He seems to have regarded with a kind of horror the plunging enthusiasm of his assistant chief. Several weeks ago he asked for General Mitchell's removal. Secretary Weeks acted as peacemaker, and the request was withdrawn. Then a few days ago a confidential report from General Mitchell to General Menoher leaked into print. General Mitchell had promised to cease making public statements, but he was evidently taking out his feeling on his chief in private. He asserted that a squadron of airplanes could destroy the entire Atlantic fleet, that the bombing tests were about a 1 per cent. indication of true aircraft possibilities, and that the airplane had made the navy obsolete for coast defense. Soon after this report became public General Menoher apparently felt it was time for him and General Mitchell to separate. This time he suggested going himself.

He has acted wisely. Undoubtedly he was in a position of responsibility with a subordinate playing a far more active and important part. Aviation is new. It needs young, confident, aggressive, and capable men like General Mitchell—men who know flying and believe in it. General Menoher was a quiet, dutiful, and unexcited gentleman who would apparently have let the old-time navy men spend their hundreds of millions without raising a bit of hell in behalf of flying. He is right in feeling he will be happier and more efficient elsewhere, and his resignation was a good deed for military aviation. It remains to be seen if Secretary Weeks can act as effectively as General Menoher. He will make a mistake if he does not give the control of the army air service to General Mitchell. The latter is a leader, not a follower, and he is a proper leader just at present, when the nation needs more modern and less expensive methods of defense than it has been planning for.

Canada Recognizes Underwriters' Aircraft Register

According to a statement issued by Underwriters' Laboratories, the Air Board of Canada has recognized the Aircraft Register of the Underwriters' Laboratories and advise that "it will not be necessary for aircraft registered by Underwriters' Laboratories and seeking permission to fly into Canada to have the letter C as the first letter in its registration marking."

To understand the meaning of the above quoted portion it is necessary to know that prior to this ruling in accordance with Canadian Air Regulations, American aircraft flying into Canada had to display the nationality mark N followed by a registration mark composed of four letters the first of which was to be C. In the scheme adopted by Underwriters' Laboratories the registration mark may be any combination of four letters. The ruling of the Air Board of Canada merely acknowledges this system.

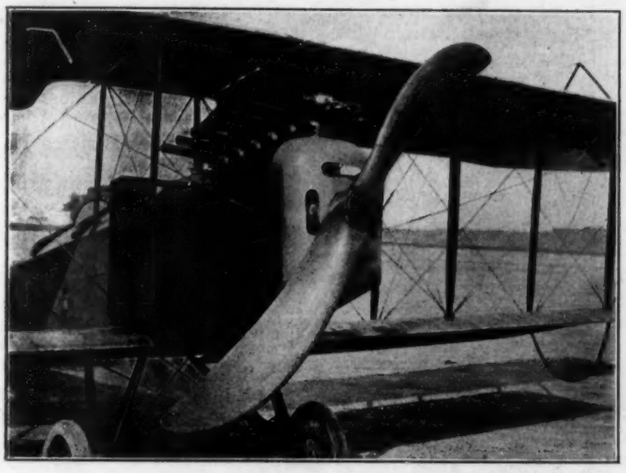
A number of applications for entry in the Aircraft Register and in the Aircraft Pilots Register is now being acted upon, so that before long it will be quite common to see civil aircraft display their identification marks.

Standard J.1 with Mercedes Engine

A Standard J-1 has been recently rebuilt by the Cox-Klemin Aircraft Corp., of College Point, L. I., N. Y., with a six cylinder Mercedes, as a three seater.

The Mercedes, 6 cylinder vertical engine, is rated at 160 hp., at 1250 r.p.m., but turns up 1550 r.p.m., at full throttle, and delivers close to 200 hp. at this speed. This power gives the machine a great range of speed maximum speed considerably more than 90 m.p.h., fast climb and reserve of power, with slow landing speed and stability and balance. The Mercedes-Standard is a useful all-round machine, suitable for the most difficult flying conditions.

Fully loaded, the machine holds altitude, and good speed at 100 r.p.m., so that it is very suitable for economical cross-country flying. The balance is good, the increased stagger of the upper wing taking care of the weight of the Mercedes motor. Ample cooling surface is provided by two side radiators. On a machine now being rebuilt, the motor is cowled in, giving the machine a more streamline appearance. Two passengers are placed in the front cockpit, and dual control can be provided when the seats are slightly staggered.



CLOSE-UP OF THE ENGINE MOUNTING IN THE STANDARD J. 1 BIPLANE REBUILT BY THE COX-KLEMIN AIRCRAFT CORP.

The photograph shows close-up of the engine mounting.

Mr. R. E. Dake, a pilot of the Mayer Aircraft Corp., purchasers of the machine, flew the machine from Long Island to Pittsburgh. The pilot's report was as follows:

"I have today flown and tested the Standard J-1 plane with Mercedes engine, assembled for Mayer Aircraft Co., by the Cox-Klemin Aircraft Corp., and have found it to be in excellent condition. The machine took off in a very short distance, and climbed fast at full throttle.

"Engine turned 1550, wide open, with machine level, and 1450 to 1500 on steep climb. Due to abundance of power, the machine climbs well at 1300 r.p.m. and will hold altitude when loaded. at 1100 r.p.m. With the exception of a slightly excess vibration at full throttle, which is easily remedied, I found the machine to be in good condition, a steep climbing, high speed, slow landing machine."

The "Santa Maria"

The flying boat "Santa Maria" of the Aeromarine Airways is now at Peoria, Ill., after having completed 20,000 miles of flying without an accident since being launched over a year ago. The machine is to fly down the Mississippi River to New Orleans and thence to Vera Cruz, Mexico, where it will be exhibited at the Aeronautical Exposition.

Aviation in Spokane, Wash.

Interest in aviation is rapidly developing in Seattle and vicinity. On one day recently there were ten machines on the Foster Russell landing field. Half of these were privately owned, the remainder belonging to the Russell Co.

Switzerland Wins G. B. Balloon Race

The 1921 Gordon Bennett Balloon Race, the start for which was given on Sept. 18 at Brussels, Belgium, was won by the Swiss pilot Capt. Paul Armbruster, who landed his balloon at Lambay Island, off the east coast of County Dublin, Ireland. Bernard Von Hoffman, pilot, and J. G. McKibben, aid, representing the United States, covered the next greatest distance, but they probably lost second place as their balloon fell into the Irish Sea some 15 miles off Dublin, where they were rescued by a passing steamer. The assistance rendered would probably disqualify them. Owing to incomplete reports at hand it is not yet possible to say who finished third. The two contestants for this place are Ralph H. Upson (United States), who landed at Brai ch y Pwll, Carnarvon County, having covered 420 miles in 27½ hr., and Ernest Allen (Great Britain) who landed at Fishguard, Pembroke County.

The complete list of the entrants who started from Brussels, in the order of the start, with the name of their balloon, and landing place follows:

1 Lt. Col. J. D. Dunville (Great Britain). "Banshee III". Landed at Gamar, Wales.
2 Maurice Bienaimé (France). "Picardie". Landed at Pandy, Wales.
3 Ralph Upson (United States). "Aero Club of America". Landed at Brai ch y Pwll, Wales.
4 Col. C. Barbanti (Italy). Landed 8 miles NW of Swansea, Wales.
5 Eduardo Magdalena (Spain). Landed 25 miles from Cardiff.
6 Capt. Paul Armbruster (Switzerland). Landed at Lambay Island, Irish Sea. Winner.
7 Lt. Ernest Demuyter (Belgium). "Belgica III". Landed at Powerstock, Dorsetshire.
8 Ernest Allen (Great Britain). "Margaret". Landed at Fishguard, Wales.
9 Jules Dubois (France). "Marne". Landed at Dolgelly, Wales.
10 Wade T. Van Orman (United States). "City of Akron". Landed 6 miles NW of Exeter, Devonshire.
11 Major Giuseppe Valle (Italy). "Trionfale IX". Landed at Aberaeron, Wales.
12 Lieut. F. Labrousse (Belgium). "Liège-Yser". Landing not known, but did not cross Irish Channel.
13 Charles Crombez (France). Landed at Brighton, England.
14 Bernard Von Hoffman (United States). "City of St. Louis". Landed in the Irish Sea 15 miles off Dublin.

New French Airway Guide

We are in receipt of a new French airway guide called Aéro-Indicateur, which is published by Ed. Blondel la Rougery, 7 rue St. Lazare, Paris, and which gives detailed information on all the public air transport services operating in Europe. It is indicative of the enormous development of foreign commercial aeronautics that this information takes up eighty pages. The information given with regard to the services in operation, such as tariffs, time tables, train and steamer connections, hotel accommodations, number and type of aircraft in service, is of the most comprehensive kind. The value of the work is greatly enhanced by the inclusion of numerous maps showing in detail the course of the various airways and a general aeronautical map of Europe.

L'Aéro-Indicateur is published under the auspices of the French air ministry, and its preface is contributed by Colonel Saconney, director of the air navigation service of said ministry.

American Machines in Canada

In view of the courtesy of the Canadian government providing licensing facilities for United States aircraft operating in Canada it is interesting to note that the August report of the Canadian Air Board shows one machine from this country operating under a temporary Canadian license. The machine is an HS2L boat seaplane, No. 4248, belonging to the Pacific Airways Ltd., Seattle, Wash., and marked, in accordance with the International Air Regulations, N-CACM.

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INDEX TO ADVERTISERS

A

Aero Import Corp 358
Aeromarine Engineering & Sales Co 383
Aircraft Materials & Equipment Corp..... 380
Aircraft Directory Service 382
Aircraft Year Book..... 380

B

B. G. Corporation, The..... 380

C

Curtiss Aeroplane & Motor Corp 362

D

Dayton Wright Co 359
Diggins, Ralph C., Co., The 381

L

Laird, E. M., Co 379
Levy, James, Aircraft Corp..... 380

M

Martin, The Glenn L., Co 384

S

Sperry, Lawrence, Aircraft Co., Inc., The 381

T

Thomas-Morse Aircraft Corp..... 361
Thurston, W. Harris, & Co., Inc..... 379

W

Warner Edward P..... 380
Wellington, Sears & Co 381
Where to Fly 378
Wright Aeronautical Corp 360

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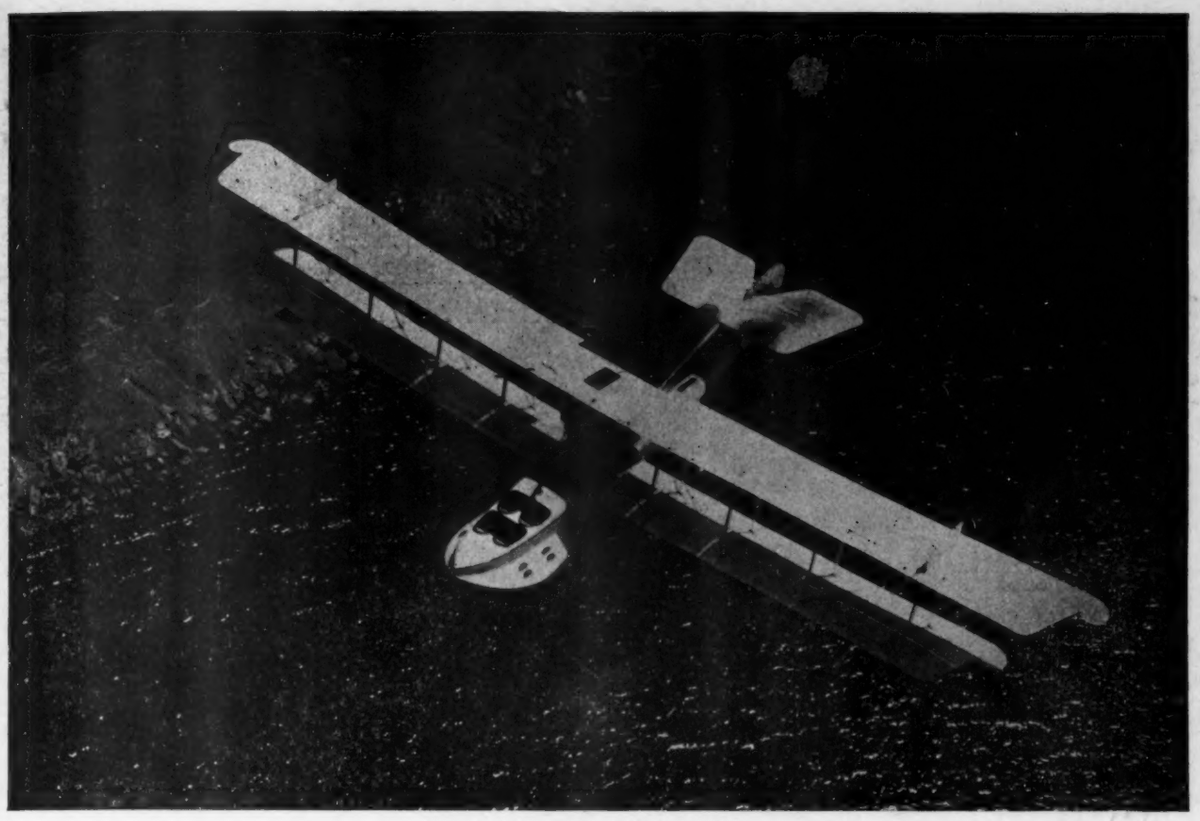

Aeromarine—Navy Open Cockpit HS2-L in Operation over the Hudson River

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OFFICIAL REPORT
From Aeromarine Airways
To Bureau of Aeronautics - Navy Department
Subject - Operation of Commercial Flying Boats
Period - First three months of operations - New York City and vicinity.

Flying Boat	Hours in air	Mileage flown	Passengers carried
Ambassador	142.25	10,088	597
Waldorf	98.30	6,983	456
Biltmore	62.05	4,388	342
Pennsylvania	99.50	6,712	662
Totals	402.10	28,171	2,007

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